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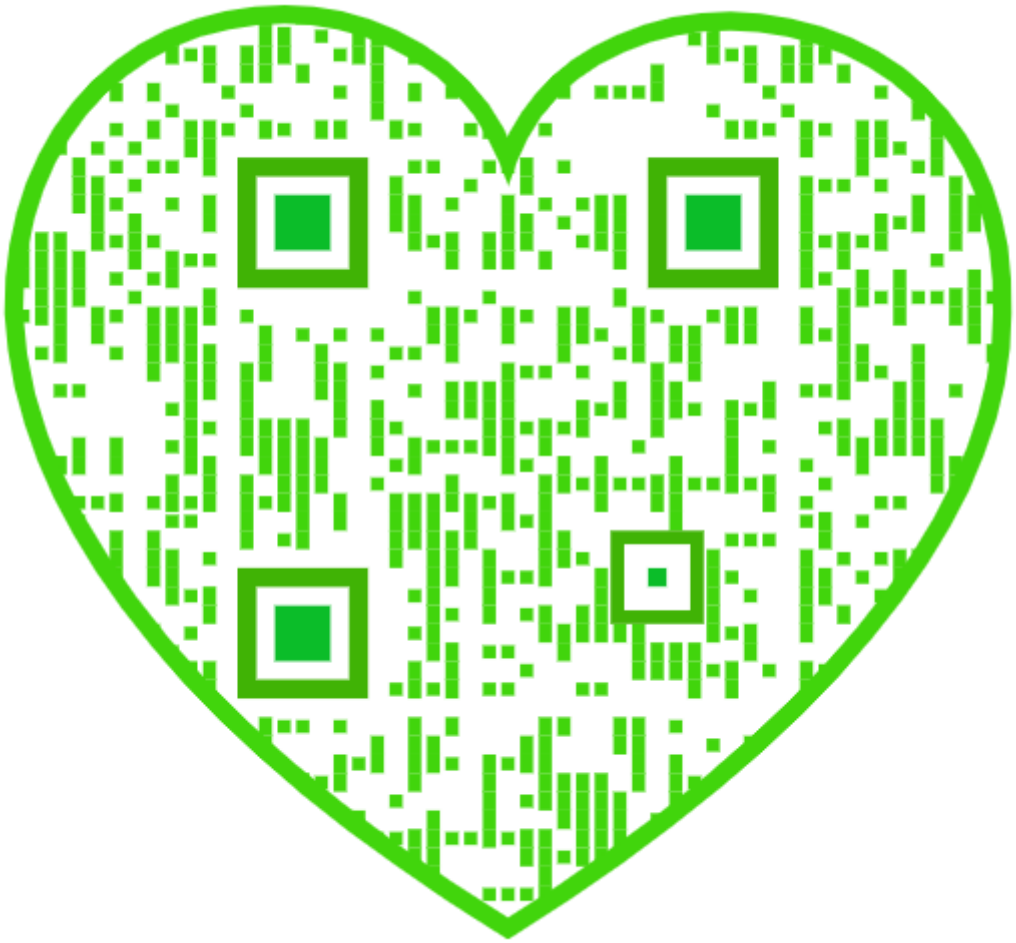
AN ORINOCO "LANCHA."—[See page 420.]



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NEW YORK, SATURDAY, NOVEMBER 25, 1905.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

TURBINE TROUBLES.

It is a matter of common remark that the comparative absence of any serious check to the steady development of the steam turbine is one of the most surprising facts in connection with the new prime mover. And yet, we doubt not that if Mr. Parsons shall ever give to the world a detailed history of the years of experimental work which preceded the production of his first successful turbine, it will be found that success was achieved, only after the inventor had trod the usual weary way of repeated experiment, frequent disappointment, and occasional success. It is a mistake to speak of the steam turbine as a perfected invention; for it will be many years before it will be developed to its ultimate limit of efficiency—a point which has undoubtedly been reached already by the reciprocating engine. In some respects the steam turbine is still in the experimental stage; and the wonder of it all is that an engine of an entirely new type should have shown such high efficiency so early in the history of its development.

Not much has been made known as to the difficulties and disappointments that have been encountered in working the crude idea into the practical machine; yet they have been many, and in some cases serious and discouraging. Thus, in the case of a large ocean steamship recently equipped with steam turbines, and placed in the Atlantic service, there has been continuous trouble caused by heavy priming. The water came over in large volume from the boilers, and on its entering the turbine its inertia proved too much for the rapidly revolving blades, and many of them were stripped entirely from the shaft. This trouble occurred to the high-pressure turbines and was so serious as to necessitate the presence of a man continually at the main throttle. Another serious difficulty, which has developed in the larger turbines, is the fracture of the blades due to their outer ends coming in contact with the cylindrical casing. Of course, the instant that they touch they are snapped from the shaft, with the result that things are pretty badly torn up in the turbine. For some time it was impossible to discover the cause of this contact, for the blades are always adjusted with sufficient clearance to avoid any contact. Ultimately, it was found on making micrometer measurements, that the blades had appreciably increased in length. After long and costly experiments the discovery was made that under certain conditions of speed, length of blade and steam pressure, an intense vibration may be developed in the blades which may become so violent as ultimately to stretch the fiber and give it a permanent set. Eventually a means was found of checking this vibration, or at least of reducing it to a point at which there was no overstraining of the metal. We understand that one of the two firms which are building the 75,000-horse-power turbines for the Cunard liners has set apart a special shop for experimental turbine work, and that already over one hundred thousand dollars has been expended in this way.

The next important event in the development of the marine turbine will be the maiden trip of the new Cunard liner "Carmania," which will sail for this port on December 2. This great ship will have turbines of over 21,000 horse-power; they will, therefore, be approximately twice as powerful as any that have been previously built. The experience gained on the "Carmania" will be of great value in the final designs, at least as to details of steam piping, condensers, etc., in the larger ships of 25 knots speed.

EYESIGHT TEST FOR RAILROAD MEN.

We are in receipt of a communication from a locomotive engineer in far-away Australia, asking us to describe the standard tests for eyesight that are now in operation on the principal railroads of the United States. It seems that on the State railroads of New South Wales the standard eyesight test for employes whose occupation renders it necessary for them to give or receive signals, consisted for many years of color tests made under practical working conditions. The tests were made with colored lights at night and colored flags by day, at an approximate distance of 1,000 yards. Our correspondent informs us, however, that during the present year the following method of testing has been adopted: Vision by Snellen's test type, at a distance of 20 feet; Color Sense by Prof. Holmgren's assorted wools and Dr. Williams' testing lantern; and Hearing, by counting the ticking of a ratchet acoumeter at a distance of 20 feet. It seems that a number of the locomotive men who were unable to pass, and were removed from their engines, failed because they were unable to read accurately the smallest type in the Vision test, namely, "type approximately three-eighths of an inch at a distance of twenty feet." Our correspondent claims that as the eye has been trained to sight signals at a distance both by day and night, it is unpractical to expect that eyesight so developed could sight small objects accurately at a short distance.

Railroad men in this country will at once recognize in the description given of the New South Wales new system of tests, the very methods which have become standard on the leading roads of the United States; and it is evident that the management of these roads are dissatisfied with the present system of long-distance tests, and have decided to adopt the more scientific and carefully-thought-out system which we have found to work so well in this country. While we have every sympathy with the locomotive men who have lost their positions as the result of the change, we think it is probable that the government railroads in New South Wales will be materially benefited by the new rule. That their new system is similar to our own is shown by comparison with that used, for instance, on the New York Central Railroad, which includes first a reading test—three-eighths inch type at a distance of twenty feet; secondly, tests for position or form, consisting of models of semaphores placed in various positions at a distance of twenty feet; third, reading test for ordinary text, such as train orders, at an ordinary reading distance; fourth, color sense, which is tested, first in daylight by displaying strands of worsted of over a hundred varieties of color, and having the men name the colors displayed, and second in a darkened room by displaying glasses of different colors in front of a lantern. Finally, the hearing is tested at a distance of twenty feet by having the men note the strokes of an acoumeter, and repeat (conversation test) words given by the examiner. The men are reexamined at the end of three years from the last examination, and also after any accident in which they may have been present, after illness, and before promotion. The system outlined above, with occasional modifications, has been in force for ten or twelve years on most of our leading roads in this country and on some for a longer period than that. Although it has been the subject of some criticism by practical men who, like our Australian correspondent, would prefer a system of tests under working conditions, the American method has given satisfaction to the railroads, and is believed to provide a surer test for the more subtle defects of eyesight.

ROBERT WHITEHEAD AND THE TORPEDO.

It is not often that the name of a single individual becomes so exclusively identified with a great invention as the name of Whitehead has with the submarine torpedo. A parallel case is that of Bessemer and his process of steel manufacture, which for so many decades remained in almost exclusive use in the steel mills of the world. The recent death of Robert Whitehead affords an opportunity to answer the frequently-asked question as to who he was, and how he invented a device which, it is safe to say, has had a greater influence upon the design of modern warships than any single invention of the past century. Robert Whitehead was an English engineer, who, while he was acting as superintendent at the Austrian government works at Fiume, became interested in the attempts of a certain Austrian officer, Capt. Lupius, to design a self-propelled torpedo. The credit for the root idea is due to the Austrian, but until he became associated with Whitehead he was unable to put it into practical shape. Naturally, Whitehead's first operative torpedo was a very crude affair, the speed being something less than 10 knots an hour and the range very limited. The Austrian navy, however, perceived the great potentialities of the device, and adopted the torpedo in 1868. Whitehead devoted himself energetically to its development, and one by one the defects of this wonderful little vessel were remedied, until it was brought up to its present high state of efficiency by the introduction of the Obry steering gear. The latest type of Whitehead torpedo can travel at a speed of 35 knots an hour; it can automatically regulate its own depth and correct its own course; and, under favorable conditions, it will make accurate attack at a range of several thousand yards.

The Whitehead torpedo, we have said, has exercised a greater controlling influence upon naval construction and tactics than perhaps any other single weapon of naval warfare. At certain periods it seems to have almost absolutely dominated naval design, and there has never been a time when its modifying influence has not been strongly felt. It cannot be denied that the torpedo has, at times, been greatly overrated. Indeed, we believe it is being greatly overrated to-day. The experience of the recent war seems to prove that only under exceptional and very favorable conditions can the torpedo get in its blow. In the fleet engagements on the high seas it seems to have been a negligible quantity, and to have exercised very little, if any, influence upon battle formations. Consequently, we think it is unlikely that torpedo tubes will be fitted into future warships. Moreover, torpedo warfare will more and more be confined to work in sheltered seas and within easy reach of a naval base. Strictly speaking, the work done by the torpedo in the battle of the Sea of Japan was of this last-named character, for, on account of the rough sea that was running, the torpedo boats and destroyers were not used in the early stages of the fight, and were not sent out until after the sea had gone down. In the defense of harbors, straits, and inland seas, however, the torpedo will ever remain an invaluable factor, and particularly so if its range and accuracy in disturbed water and against swiftly-moving ships can be brought up to the proper standard.

MODERN PRESERVATION OF RAILROAD TIES.

Within the past twenty-five years the price of all kinds of timber for architectural and structural purposes has advanced nearly 100 per cent, and the burden on the railway, electric lighting, and telephone companies has increased in proportionate ratio. Apparently no satisfactory substitute for wooden ties or poles has been found, and the dependence upon the forests for supplying mature trees is imperative. The planting of large acreages of private forests with quick-growing varieties of trees has been undertaken by a number of the large western railroads, but the experiments are still too young to demonstrate anything of general practical value. Until such systematic reforesting of our lands can be made, the leading railroads and telephone companies must resort to artificial means of prolonging the life of their ties and poles.

The preservative treatment of ties both for the steam and electric roads has been carried on now long enough to indicate the relative value of the different oils and chemicals employed. The experiences of the steam roads have been that treatment of ties is both economical and desirable, and the results secured far more than offset the initial expense. Nearly all of the railroad ties treated are by the zinc-creosote and zinc-chloride processes. Owing to the comparatively low cost of treatment with these materials, the ties can be economically increased in durability from five to ten years. More expensive chemicals, such as sulphate of ammonia and sulphate of aluminium, prolong the life of wood much greater than treatment with zinc chloride, but their higher cost makes the question of profit doubtful.

Few accurate records of the relative value of treated and untreated poles and ties date back prior to 1897. To-day, however, the foremost steam and electric railroads mark their treated and untreated ties and poles to ascertain their relative age of usefulness. On most of the western roads the life of the tie that has been treated is ten years, but a few ties put down in 1885 and treated by the zinc-creosote system, have lasted upward of fifteen years.

The railroads interested in the subject now employ dating nails which are driven in the upper side of every tie treated. These dating nails enable the track foreman to keep an accurate record of the age of every tie taken up. Copper nails are sometimes used for this purpose. The early galvanized and steel dating nails rusted so badly that at the end of two or three years the date was destroyed. However, several roads use steel dating nails galvanized with a coating of zinc. Samples of the nails are first immersed in a standard solution of copper sulphate for one minute, and then removed and washed and wiped dry. This is repeated four or five times at intervals, and if the zinc has been removed or a copper-colored deposit is found on the surface the nails are rejected. In this way dating nails are obtained which will last as long as the ties without having the date rusted away.

Ties used on railroads are subjected to much greater wear and tear than those employed for interurban electric railways, for the traffic is much heavier and more destructive to the wood. But few ties are worn out. Decay ends their years of usefulness first, and if decay could be arrested entirely ordinary ties that last ten years now could be made serviceable for twenty and thirty years on electric lines.

The source of decay or decomposition is in the air and water rather than in the wood itself. Minute animal or vegetable organisms floating in the air or water come in contact with the albuminous substances in the wood. Under favorable conditions of heat and moisture they multiply rapidly and destroy the timber. To prevent this it is necessary that an antiseptic with

germ-killing properties be applied to the surface of the ties. Moreover, the organic matter composing the cellular tissue of the wood must be sterilized and rendered inert so that the germs can find no nutrition in them. Theoretically, this can be obtained in a number of ways, but owing to the expense of the different processes it is not always profitable to treat poles and ties.

Most of the ties used by the railroads of the country are treated by the zinc-chloride process, but a few have tried the zinc-creosote and the zinc-tannin processes. On the Chicago & Eastern Illinois Railroad about 64 per cent of the red oak ties, numbering 860,000, that were put down in 1899 have been taken out to date. These ties were treated by the zinc-tannin process. It is estimated by the engineers of the railroad, however, that all of the ties of red oak would have been out before this had they not been so treated. The railroad owned its own plant for treating the ties, and the cost of the work for each tie can alone determine whether the experiment was profitable. The fact that all subsequent ties are thus treated before laying indicates that the railroad engineers consider treated ties more economical than untreated.

The Pittsburg, Fort Wayne & Chicago Railway experimented with ties put down in 1892. A number of white oak ties were used without any treatment, and a similar number of tamaracks and hemlocks treated by the zinc-tannin process. All of these ties have been removed except a few of the hemlocks, and they are to be removed this year. But the fact that the tamaracks and hemlocks lasted as long as the white oak ties is a sufficient proof of the value of the treatment. The ordinary life of the hemlock is much shorter than that of white oak, and its cost in New England is much lower also.

The Atchison, Topeka & Santa Fe Railway treats its ties with the zinc-tannin process, and the records show that treated hemlock had an average life of 10.71 years, untreated white oak 10.17 years, and treated tamarack 8.84 years. Improvements in the processes of treating ties have been steadily made since these experiments were begun, and the life of the treated ties is thus considered much longer to-day than formerly; but as it takes from ten to fifteen years to secure reliable data it is impossible to give figures that will show the difference between the old and new methods.

The question of using higher-priced chemicals for treating ties and poles has been repeatedly brought forward, and a number of the roads are carrying on experiments on a small scale to ascertain the economy of the different processes. Unless the life of the ties can be increased considerably the extra cost of the chemicals will render the work unprofitable. Each year gained on every tie, however, represents an enormous economy on the large lines. By bringing the average life of the abundant soft woods up to that of the hard woods by using preservatives of a cheap nature, millions of dollars can annually be saved to the railroads of the country. The question of cost of ties for the different systems is largely a matter of location. In the Southern States, where the long-leaf pine and cypress trees are plentiful, they are used in preference to all other woods for ties, and the important question at issue is to find the most satisfactory and economical method of preserving such soft woods so they will last from ten to fifteen years.

In New England, spruce, hemlock, tamarack, pine, and chestnut trees are most abundantly used, and their relative age of durability is almost in exact proportion to their cost. On the California coast the redwoods are most commonly used, and in the central and prairie States white and red oak, catalpa, tamarack, and hemlock. By treating the softer woods with preservatives most of the roads have succeeded in lengthening their lives so that they can be used almost as satisfactorily as the hard woods. The cultivation of forests of soft woods for railroad ties is an important branch of railroading for the future, for their growth is much more rapid than the hard woods, and if by being treated with chemicals they perform equally good work, the tie problem will be partly solved. Meanwhile, engineers and chemists are busy testing new processes of treatment, and the difficulties now presented in securing ties that will do service for ten to fifteen years are gradually being eliminated.

FUN WITH THE PHONOGRAPH.

BY DEXTER W. ALLIS.

Few owners of the phonograph realize the great versatility of this machine as a source of amusement. By its use the following experiments may be carried out. In addition to the machine itself, a recorder and a few blank records will be needed.

"Speech by Tom Thumb." The machine must be speeded up as high as possible, and the above announcement recorded on a blank in a deep, loud voice. The machine should be quickly slowed down to about eighty revolutions per minute, and the speech or monologue recorded at that speed, care being taken to articulate distinctly. When the blank is full, the reproducer may be substituted for the recorder, and the machine be brought up again to high speed at which the announcement was made. When the record is reproduced at this speed, the result will be the loud voice of the announcement followed by a rapid, pinched-up little voice making the speech.

"A Whistling Duet by John Smith." This startling announcement through the horn would create much surprise.

Put on a blank; and, after the speed is at about 160 revolutions, whistle some popular piece of which you know the second part. When the record is full, set the recorder back to the beginning again without stopping the machine. When the recording point gets to the commencement of the piece, the first part will sound faintly in the recorder, thus giving the cue and the pitch for the second, which should be recorded not quite so loudly as the first.

Several modifications of this experiment will suggest themselves. The first attempt may not be perfectly successful, but that need not be considered a drawback, as a spoiled record can be easily cleaned with a rag and a little kerosene. The rubbing should be lengthwise of the cylinder till the lines are all removed, after which a soft cloth is rubbed around the record to give a polish. Hard or gold molded records may also be cleaned in this way, which fact suggests another amusing trick.

This will call for two records, preferably talking selections, which are exact duplicates. One of these is "doctored" by cleaning off the latter half, the rest being protected by a piece of writing paper wrapped around and secured by an elastic band. On this blank space various remarks should be recorded, which should be very different from those originally there. The good record is to be played through first. While saying that you will repeat it, the second one is quickly substituted in the machine, and of course starts off exactly like the first one. When the "doctored" portion is reached, however, a change will be noticed, but cannot be accounted for by the hearers.

By taking two records of entirely different character, cutting each in two, and putting on a half of one and a half of the other, we can often jump from the sublime to the ridiculous by quickly flipping the reproducer across the gap, from one to the other. With care the thinner half of one of these records may be slipped halfway on, in a reversed position, and when made to run true, will produce everything backward. A curious thing about such records is that the voice one heard in the proper direction is instantly recognized when reversed, but is, of course, unintelligible.

FREDERIC H. BETTS.

In the death of Mr. Betts, which occurred on the 11th instant in this city, a lawyer of unusual capacity and brilliancy, especially versed in patent law, was removed from the ranks of those prominent in its practice.

Mr. Betts was born in Newburg, N. Y., in 1843, was graduated from Yale University in 1864, and was admitted to the Bar from Columbia College in 1866. It was shortly after this that he became acquainted with Mr. Alfred E. Beach, then one of the proprietors of the SCIENTIFIC AMERICAN, who suggested to Mr. Betts the advisability of taking up the study and practice of the patent law, particularly in its higher aspects before the courts. He followed the suggestion, and soon became prominent and successful in being able clearly to present the salient points of cases committed to his care. During recent years he acted for the American Bell Telephone Company, the Western Union Telegraph Company, the Edison Electric Light Company, and several other prominent corporations.

Mr. Betts was always deeply interested in Yale University. He founded the Betts prize in the Yale Law School, and was for a long period lecturer on patent law in the law department of the university. He was also vice-president of the Yale Alumni Association, and in the eighties was connected with several New York citizens' committees and reform organizations.

In 1869 he married Miss Louise Holbrook, a daughter of John F. Holbrook, of New York. The widow and three children—two sons and a daughter—survive him.

For the last few years Mr. Betts was connected in a legal capacity with the firm of bankers of J. P. Morgan & Co., and was regarded as one of the most prominent lawyers in New York. The funeral services were held on the 14th instant in St. George's Church of this city, of which Mr. Betts was a vestryman. Many prominent persons were in attendance.

Mr. Betts will be remembered for his sterling ability as an expounder of the principles of patent law, and their application in the adjudication of difficult and uncertain cases.

In a contribution to the St. Louis Medical Review, of October 21, Dr. John Zahorsky protests against the fashion of using no cradle, urges the return of the cradle to the nursery and predicts that this useful article of furniture will be in style again before long. He cites a number of authorities to prove that "the soothing, rocking movements of the cradle are positively beneficial," particularly when infants are peevish. "The cradle is one of the best therapeutic agents for a nervous baby or a sick one," says he. "It is easier on the mother and preferable to the modern succedanea, pacifier, or paregoric."

SCIENCE NOTES.

M. Camille Flammarion has been making some experiments at the station for climatologic agriculture of Juvisy, in the suburbs of Paris, to see whether the moon exerts any influence upon the growth of plants, according to the popular opinion. He made different sets of plantings at dates which corresponded to the different phases of the moon, using peas, beets, carrots, potatoes, beans, and many other vegetables of the ordinary kinds. After some experimenting he found that the results which were observed on the growth of the plants were extremely variable, and no fixed rule seemed to govern them. The plants appeared at periods which had no connection with the moon's phases, so that it was impossible to draw any definite conclusions from the first series of experiments. M. Flammarion is to continue his observations on this subject and sooner or later will no doubt have results which will decide this much-disputed point.

Electric traction on the Teltow canal, which is one of the principal canals in Germany, is shortly to be applied on a large scale, in accordance with a programme formerly decided upon. It will be remembered that a number of experiments with different forms of tractors were made along the canal, and these showed that the electric system offered many practical advantages. A large central station for supplying the current has already been erected, and is about completed at present. It already contains a 400-horse-power dynamo and engine group and two large steam turbine and dynamo sets of 700 horse-power each. The station will be prepared to furnish current very shortly. The extensive system of locks will first have an electric system for operating it. The rails for the electric locomotives have been laid along the canal in the eastern section between Grünau and Britz, on both banks. The overhead wires and the poles are being put in place, so that it will not be long before the locomotives will be ready to haul the canal boats.

Some rather remarkable results which have been obtained in a series of researches upon the radiation given off from polonium are mentioned by B. Walter, a German physicist. According to him, the α rays of polonium under certain conditions give rise to a luminescence of the air when passing through it. In this case there seems to be an emission of a certain kind of radiation which has a very pronounced photochemical effect, one whose properties are to be compared with those of the spectrum which is included between the rays $\lambda = 350$ and $\lambda = 290$. This radiation is absorbed by a sheet of aluminium 0.0004 inch thick, but it will pass through a plate of glass 0.006 inch thick. This emission seems to be produced especially in the presence of nitrogen. With hydrogen and oxygen the effect is fifty times less intense. Other researches in the same field bring out some of the oxidizing effects caused by bromide of radium. This action is shown when a tube containing bromide of radium is brought near a solution of iodoform in chloroform. A purple color of the solution is observed in the solution even when it is separated from the radium salt by screens of glass, mica, or cardboard. This chemical action does not result from luminous rays but from the special radiations which can pass through the screens. It seems that the β and the γ rays are the only ones which cause the oxidizing phenomena.

Delegates from all parts of the world attended the recent Congress of World's Economic Expansion which was held at Mons under the patronage of King Leopold II. International expeditions to the North and the South poles were discussed and these projects were adhered to by many of the most eminent explorers such as Arktowski, Nordenskjold, Brune, Nansen, Von Drygalski, Racovitza, Charcot, Cook, Peary, and the Duke of Abruzzi. The congress will thus be called upon to lay the foundation for an international association for the study of the polar regions. Besides this important work, the congress made the projects for two international institutions which will be of great value. The first of these is an international Bureau of Ethnography which will collect the documents and specimens furnished by explorers of all countries and will publish the needed information at intervals. The second project is for an international Bureau of Statistics which will centralize all the documents concerning this field and will thus be able to give very important information. Different conferences are no doubt to be held in the future in order to decide certain questions such as an international definition of tonnage of vessels, which is now measured by different methods, also to regulate the speed of ships during fogs and to decide other questions relating to the marine. The statistical section wishes to hold a conference in order to fix the principles of general statistics and to decide other questions of this nature.

AN AUTOMATIC CARTRIDGE-COUNTER FOR MAGAZINE RIFLES.

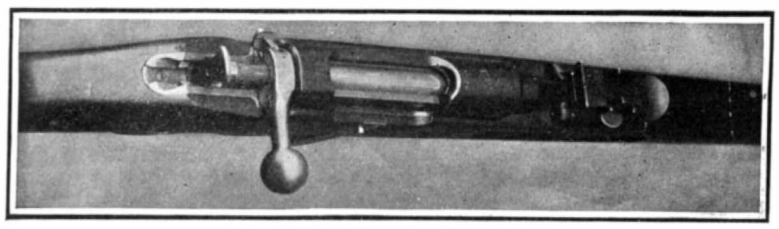
BY DR. ALFRED GRADENWITZ.

Ever since magazine rifles were introduced into current practice there has been a need for a device enabling the number of cartridges left in the magazine to be ascertained readily without opening any part of the rifle. In fact, numerous instructions issued for infantry troops oblige both the riflemen and commanders to bear in mind at any moment the amount of ammunition remaining in the rifles. Now, if the magazine has to be emptied in order to ascertain the accurate number of cartridges left, there will be a loss of time and, under certain conditions, some danger, quite apart from the risk of losing some ammunition dropping out of the magazine. Moreover, the attention of the men will be diverted completely from the enemy, or from the commander.

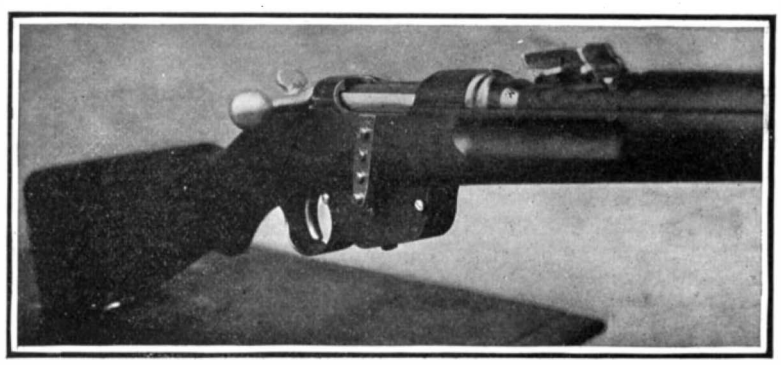
An apparatus invented by Dr. Gottardi, of Innsbruck, will doubtless be welcomed in military circles. This cartridge-counter is an extremely simple device, causing a number of checking buttons corresponding to the number of cartridges left in the magazine to project in a readily visible and touchable manner from the right-hand wall of the magazine. This device is readily adapted to any kind of magazine rifles, as also to pistols.

Our illustrations show the cartridge-counter as adapted to type 95 of the Austrian rifles. The supporting spring of the magazine is somewhat modified, and is narrowed toward its end, while its cross-section is increased, so that the power of the spring is augmented. The counter is situated at that point on the rifle where the rifleman, in the "clear" position and in pointing, keeps his left hand, so as to enable him readily to ascertain the condition of the magazine without inspecting or touching the apparatus.

Special advantages will be derived from this device, not only by the men, but also by commanders, who will be able to watch either with the naked eye or with a field-glass the condition of the magazines of their men.



One Cartridge in the Magazine and One in the Barrel.



Four Cartridges in the Magazine and One in the Barrel.

AN AUTOMATIC CARTRIDGE-COUNTER FOR MAGAZINE RIFLES.

A NEW TYPE OF ORE-UNLOADING BUCKET.

BY W. FRANK M'CLURE.

The ore-unloading machines most recently installed at the world-famous port of Conneaut, and known as "fast plants," are playing a most important part in the making of the marvelous unloading records which are being chronicled this season at that harbor. There are four of these machines, and in the making of the recent unloading records they have been used simultaneously with the giant Hulett clamshell machines, which were fully described some time ago in the SCIENTIFIC AMERICAN.

The Brown fast plant is an abbreviated Brown hoist, spanning two or more railroad tracks, with arms or cantilever extending beyond. The storage feature is limited or else eliminated entirely. As will be noted in the accompanying photograph, the machine is very compact in form. Loading, as it does, directly into cars, the movements of the bucket are short and fast. While Brown fast plants have been installed at West Albany, N. Y., Jersey City, Port Richmond, Cleveland, and elsewhere, they are all of different styles and dimensions. None of them are duplicates of the ones at Conneaut, and none of as great capacity. Those at Conneaut and at Port Richmond are operated by electricity, and all others yet built by steam. The contract for the building of the four fast plants at Conneaut stipulate that each one shall be capable of unloading seventy-five per cent of the cargo of any modern steamer with hatches twenty-four feet center to center, without the aid of hand labor in the hold of the vessel, and at the continuous average rate of 150 tons per hour. The bucket in use on these machines is a patent two-rope grab bucket. It is operated by two ropes, which work around sheaves in the top of the bucket, one operating the shell and the other the spades at the will of the operator. The bucket can thus be lifted and the spades remain open. The bucket can likewise be engaged in digging without being lifted. This style of bucket can be used in coal, limestone, and other materials as well as iron ore. The ones in use at Conneaut, and which are shown in the photographs, each have a capacity of five tons. The weight of each bucket is about 11,000 pounds. The total weight of the trolley and bucket is 59,400 pounds, and the weight of the crane 337,000 pounds.

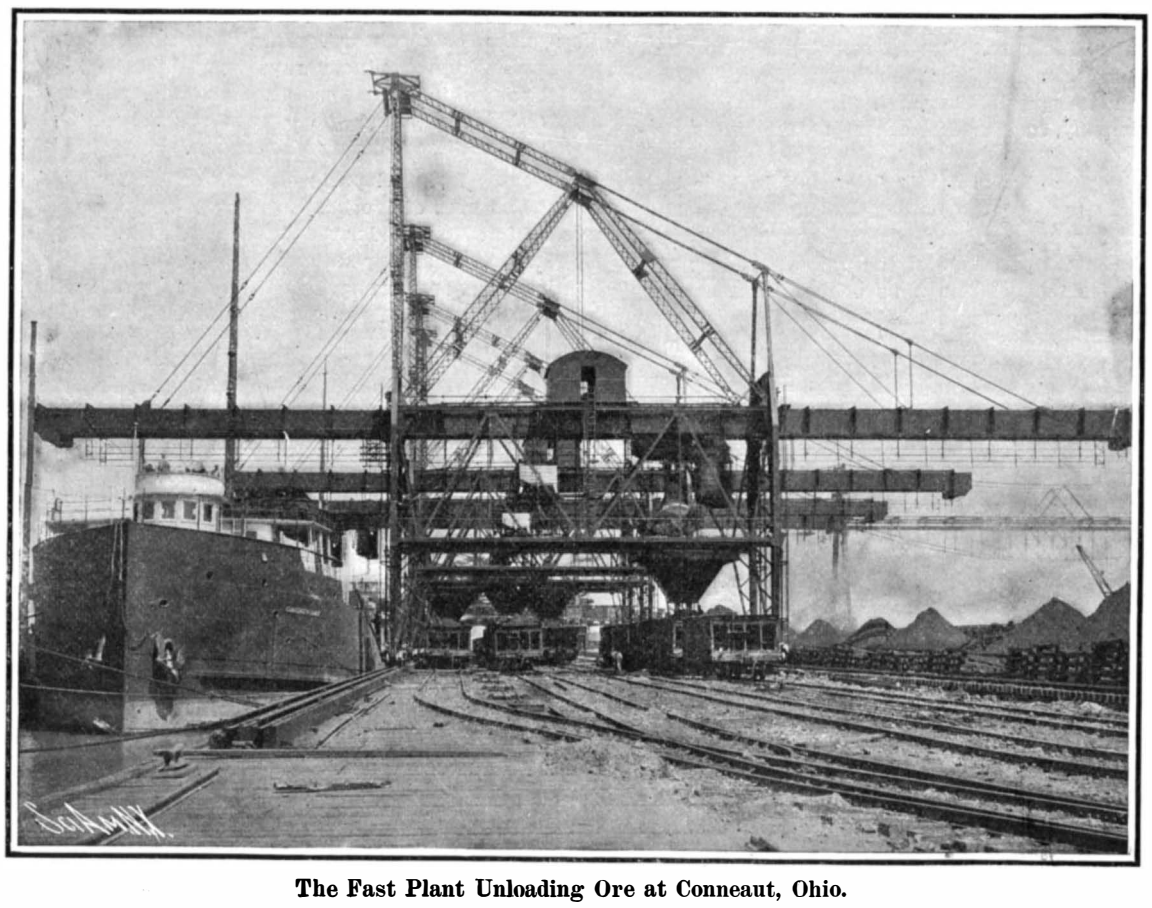
During one of the tests of this machine, between the 19th of one month and the 27th of the month following, four machines handled 164,326 tons in 978 hours and 35 minutes, the average number of tons per hour being 167.92, and the per cent of the cargoes handled exceeding 75 per cent. The hoist on the machines at Conneaut is operated by two 150-horse-power motors and has a speed of 300 feet per minute, the trolley travel 100-horse-power motor and a speed of 1,000 feet, the bridge travel one 75-horse-power motor and a speed of 75 feet.

As heretofore stated, a favorite way at Conneaut docks, in unloading the largest ore carriers, on which the world's records have been made, is to operate these machines in the vessel simultaneously with the big clamshell or Hulett automatic unloaders. It will be recalled that the Hulett machines are operated by hydraulic power, that the buckets have a capacity of 10 tons, and that the entire weight of each of these machines is 400 tons. The fast plant and the Hulett machines stand side by side on the docks of the Pittsburg and Conneaut Dock Company, and the large dimensions and number of hatches in the modern lake freighter admit of both styles of machines being in use at once. The first of the recent great records for unloading one of these monsters was made soon after the installing of the fast plant at Conneaut, which made it possible for this dock to operate the two kinds of machines in one boat. This record was the unloading of 9,945 tons of ore from the steamer "Wolvin" in four hours and thirty minutes, which cut the former record at South Chicago square in two. Not long ago this latter record was broken, when the Hulett automatic unloaders and the fast plant unloaded the steamer "George W. Perkins" of 10,514 tons in four hours and fourteen minutes.

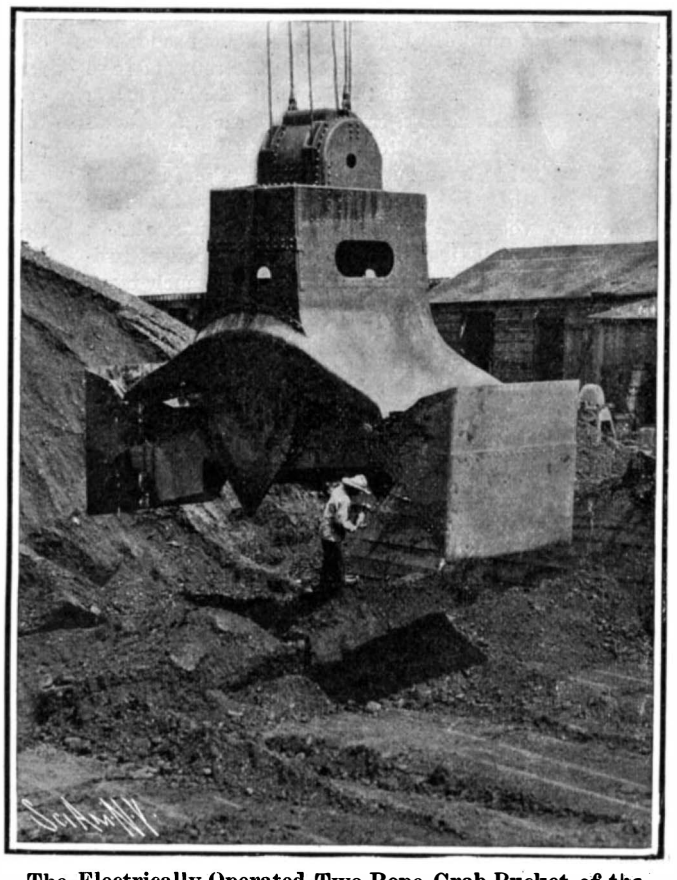
While some other ports are handling a larger volume of traffic this year than Conneaut, that harbor still holds all records for fast unloading, and most of the largest steamers still go there to be unloaded.

A fair estimate of the damage done annually by weevils to chestnuts grown in the United States would probably fall little short of 25 per cent, while in some years the percentage exceeds that figure, running as high as 40 or 50 per cent. Growers in some localities report no damage, others place losses as low as 5 or 10 per cent, while instances are cited of whole crops being destroyed. The amount of loss is dependent on locality, season, and to a more limited extent on the variety of nuts grown. The greatest damage is usually incurred in regions where chestnuts have grown wild for many years, and the least where there are no wild chestnuts or chinquapins and the nuts are grown only for market and are carefully gathered. The most extensive losses, judging from available sources of information, appear to be in Massachusetts, Pennsylvania, New Jersey, New York (in the vicinity of New York city), Delaware, Maryland, Virginia, Tennessee, and North Carolina.

In view of the many applications of timber and its growing scarcity, matches are now being made of paper, rolled spirally and dipped in wax or stearine, which prevents unrolling and gives rigidity. The roll is cut into lengths, which are then dipped in the phosphorus composition, and the matches are said to burn remarkably well.



The Fast Plant Unloading Ore at Conneaut, Ohio.



The Electrically-Operated Two-Rope Grab-Bucket of the Fast Plant at Conneaut, Ohio.

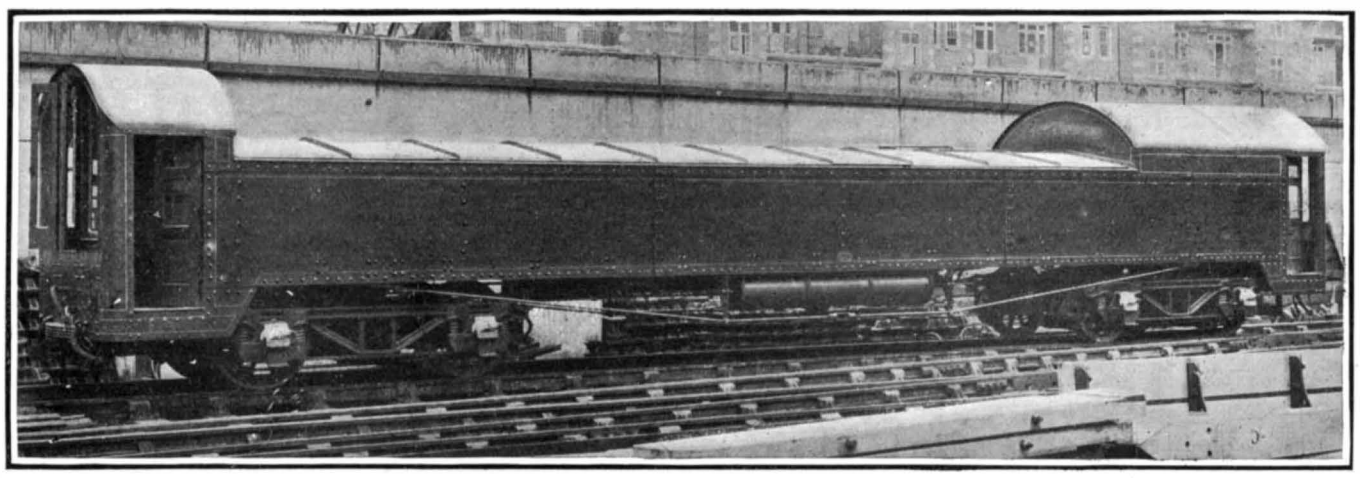
A NEW TYPE OF ORE-UNLOADING BUCKET.

A STORAGE-BATTERY LOCOMOTIVE.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

A novel type of electric locomotive has been designed for service upon the Great Northern, Piccadilly & Brompton Railroad, the new deep-level tube for London, that is in course of construction. In this locomotive the motive power is derived from storage batteries.

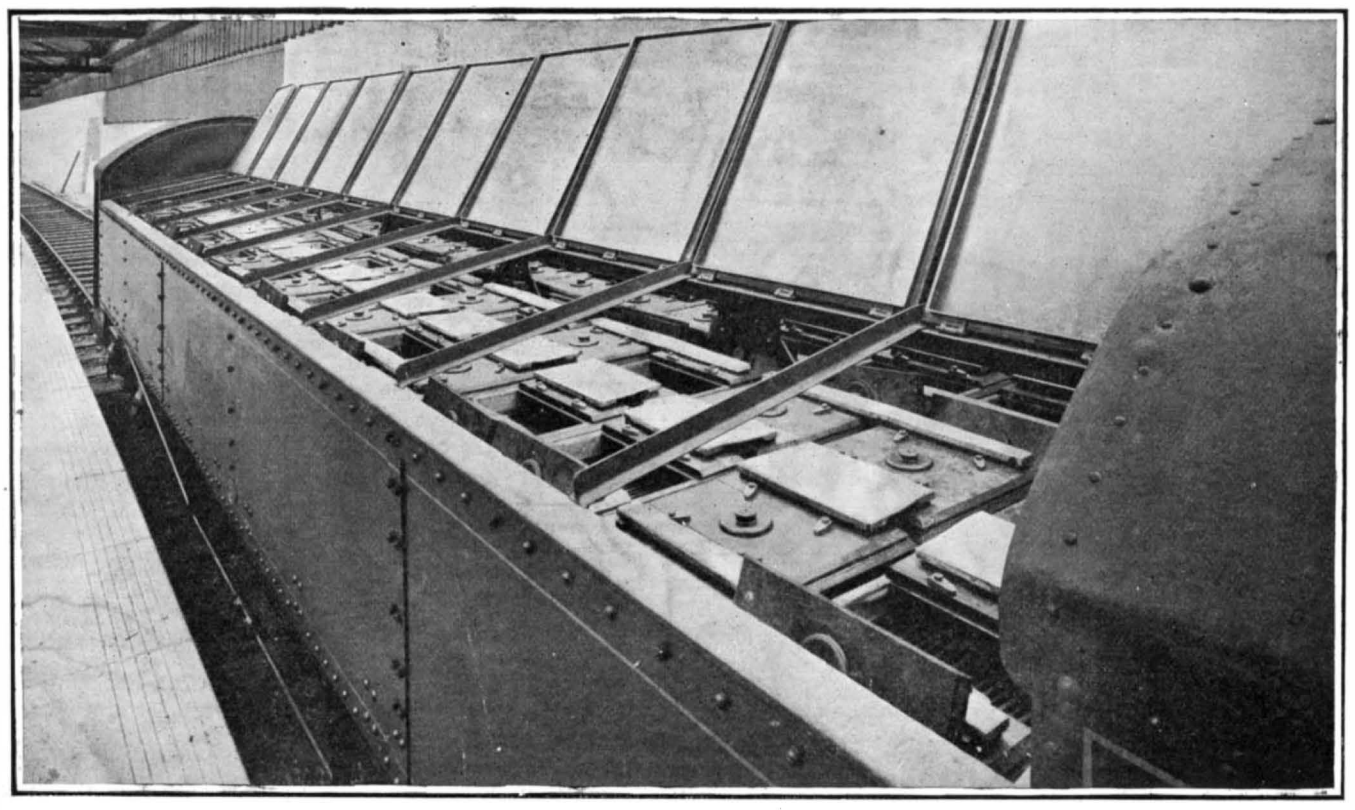
This engine has been especially constructed for the transport of the excavated ballast from the railroad head, and the carriage of the constructional materials such as the iron segments for lining the tube, rails, ties, etc., to the point of erection. The general practice of carrying out this work with animal traction proved too slow and laborious. With the aid of this battery locomotive a train of several cars can be hauled simultaneously, thereby considerably facilitating and expediting the work. When the railroad is completed and opened for traffic the storage battery locomotives, of which two have been built, will be requisitioned for breakdown work, such as hauling trains out of the tunnels when the current fails, shunting, and other side-track work.



Electric Storage Battery Locomotive for Construction and Emergency Use in One of the New Deep-Level Subways of London.

The general appearance of the locomotive may be comprehensively gathered from the accompanying illustrations. The total length of the engine is 51 feet 3 inches over buffers and 49 feet 3 inches over the body. The total width is 8 feet and the height from the rail level to the top of the driving cabs 9 feet 6 inches and to the top of the battery tank 6 feet 8 inches. There are two driving cabs, one at either end. Each cab is fitted with a British Thomson-Houston master controller, so that the locomotive may be driven from either end. The two driving cabs, however, are not of the same dimensions, one occupying only 3 feet 6 inches of the total length of the locomotive, while the cab at the opposite end takes up 10 feet 10 inches. The larger dimensions of the latter cab are necessary for the accommodation of the controlling apparatus and braking equipment, comprising air compressor and receiver. Between the two driving cabs is placed the tank for carrying the storage battery cells, the length of the tank being 34 feet 11 inches.

The locomotive comprises a main floor or platform built of channel steel 9 x 3½ x ½ inches, the side sills being 8 x 2 x ½-inch steel girders, and provided with a flooring of jarrah wood.



Battery Compartment Containing 80 Cells of 230,400 Watt-Hours, or 308 Horse-Power-Hours, Capacity.

This battery supplies 40 horse-power normally and as high as 160 horse-power in emergencies.

The frame is carried upon two four-wheeled bogie trucks, to each of which is fitted a British Thomson-Houston electric motor wound to 160 volts. The driver's cabs and battery tank are constructed entirely of steel, and the cabs are so arranged that they join the portion carrying the battery.

The battery equipment is carried on the jarrah wood floor. The accommodation for the cells is divided into two sections by a lattice girder frame extending longitudinally through the tank and so arranged as to provide a sloping top from the center to either side of the tank. The roof comprises throughout a series of doors placed on either side of the central girder to which they are hinged, so that access may be easily and quickly gained to any separate cell, or the roof may be entirely opened. The battery comprises eighty cells of the C. W. type, each cell containing twenty-one plates, supplied by the Chloride Electrical Storage Company, Ltd., of Manchester. The plates are contained in lead-lined wood boxes, fitted with lids. The capacity of the equipment is a normal discharge of 179 amperes, and a maximum emergency rate of 800 amperes, the total available energy being 230,400 watt-hours.

The total weight of the locomotive is approximately 65 tons, of which 31 tons represents the weight of the batteries. The free running speed on the level when hauling a load of 60 tons ranges from 7 to 9 miles per hour. The batteries are of sufficient capacity to operate the locomotive for a whole working day upon one charge, the re-charging being carried out during the cessation of work at night. The locomotive is fitted with automatic center coupler buffers, and the Westinghouse air brake. A special type of flat car has been designed for operation with this locomotive. These cars are constructed simply of steel girders and plate floors mounted on wheels, and are fitted with air brakes.

The working of these engines is being closely followed by engineers interested in electric railroad traction, since they should prove of great value for emergency purposes. As their motive power is self-contained they are useful for the haulage of trains that have been brought to a sudden standstill upon an electric system owing to failure from any cause of the current supply.

Korn's System of Electrical Telephotography.

The problem of transmitting pictures, drawings, signatures, and the like over considerable distances is old; in fact, it dates back to the fifties of the nineteenth century. Many attempts have been made to solve it, but with scant meed of success. Now, however, the difficulty seems overcome, judging from a lecture given on October 28, 1905, by Prof. Korn, of Munich, before the Electrotechnischen Verein (Electrotechnical Union) of Berlin, accompanied by demonstrations with the apparatus itself. Prof. Korn's apparatus is able to transmit a perfect copy of a *carte de visite* within the brief space of ten minutes, and, should it be found practicable by the German postal authorities, who are now testing it, it will inaugurate a new era in connection with press work, criminal investigation, transmission of photographs of fugitives from justice, etc. We will now describe the apparatus itself. Both the transmitting and receiving station are provided with two perfectly synchronous cylinders (i.e., two cylinders running with perfect uniformity of speed and motion, although hundreds of miles may intervene between the two stations), similar to the mechanism already known in connection with the Hughes printing telegraph, and the Siemens telegraphic apparatus. With Korn's apparatus the cylinders at both stations are actuated by shunt-wound electromotors, and an automatic regulating device is employed to prevent any lack of uniformity in their running. The cylinder at the transmitting station is of transparent glass, and the photograph (which has been copied upon a translucent film) is wound around it. A casing at the side of this cylinder carries a Nernst lamp, the light from which is, by means of a lens, concentrated upon a small spot on the surface of the cylinder. Now, according to whether more or less transparent parts of the photograph wound upon the cylinder pass the spot of light, can more or fewer rays of light penetrate the interior of the cylinder. As the cylinder not only rotates but also slowly moves lengthwise, each point of the photograph is compelled to pass under the spot of light. Inside the cylinder there is also a selenium cell, composed of a coil of selenic wire, upon which the light penetrating the cylinder impinges. Selenium is a non-conductor when in the dark, but the more it is illuminated the greater does its conductive power become. This cell is in connection with a battery, and a wire which leads to the other station. Now, when a dark portion of the photo to be transmitted passes the spot of light, no light will be able to penetrate the interior of the glass cylinder at the transmitting station; the selenium cell inside this cylinder becomes non-conductive and no current will be able to leave the battery through the said cell and find its way to the receiving station. The brighter the parts, however, which pass the light spot, the stronger will be the currents passing to the receiving station, where they (being in themselves too weak to be used for reproducing the photograph) are employed to release other currents of greater power.

At the receiving station there is another synchronous glass cylinder, perfectly similar to that at the transmitting station. It is covered with sensitized paper, and facing it there is a small Tesla tube which is made luminous by subjecting it to Tesla currents. The whole of this tube is covered with indurated rubber in such wise that light can only escape at one point, whence it falls upon the surface of the sensitized paper in the form of a spot of light. The Tesla tube is fed by the already known Tesla inductor, one of which is provided at the transmitting station. If left to itself it would, of course, give a uniform light and merely blacken the sensitized paper all over; to prevent this, use is made of the photographic currents coming from the transmitting station, and to this end they are made to operate a sensitive galvanometer. Under the influence of these photographic currents the fine needle of the galvanometer executes a greater or less movement, and acts upon the Tesla apparatus in the same ratio. According to its position it switches more or less resistance into the Tesla circuit, thus causing the Tesla tube

to become more or less luminous. In this manner an exact copy of the photograph at the transmitting station is reproduced upon the printing-off paper.

This process can also be used for the transmission of handwriting. In this case the matter is written with non-conductive ink upon tin-foil, which is then drawn through a contact device. Closing of the current then takes place upon the surface of the metal, whereas, owing to the nature of the ink, the current is broken at the written characters; in this way the above described photographic currents are produced, which are then used at the receiving station as stated above. At present from 500 to 600 words can be transmitted per hour, giving an exact replica of the original; or a stenographed message of 3,000 words can also be telephotographed in the same time.

Terms Employed by Foresters and Loggers.

"Terms Used in Forestry and Logging," just published as Bulletin No. 61 of the Bureau of Forestry, affords the lay reader an insight into a strange vernacular.

The first half of the pamphlet is devoted to forestry. There we may read all the technical terms in good use, from "absolute forest land" to "yield table." Many terms explain themselves, but where they are not so readily understood the short definition makes plain at once the idea conveyed and the need of a special word or phrase to convey it. Perspicuity, precision, and common sense seem to have been the objects sought by the compilers.

On turning to the logging terms, which are listed in the last half of the bulletin, we come across some truly remarkable expressions—terms which, though evidently derived from slang, are now in good use among woodsmen either throughout the country or in the region denoted in each case. There the uninitiated may learn the distinction between a "ball-hooter" and a "boom rat," between a "bull cook" and a "cattyman," and find that none of them refers to any lesser animal than the logger himself. Among other creatures of the logging camp may be numbered also the "alligator," the "dolphin," the "dog," the "pig," and the "road donkey," all names of objects endowed with life by the vernacular of the logger. The "alligator" proves to be "a boat used in handling logs;" the "dog" a "short, heavy piece of steel;" the "pig" a "rigging sled;" and the "road donkey" a donkey engine mounted on a heavy sled, etc. Birds are represented by the "blue jay" and the "rooster" (also called "gooseneck"), reptiles by the "snake," and insects by the "katydid." A tenderfoot intending a visit among the brawny loggers in the North Woods, the Appalachian Forest, or elsewhere, should find it decidedly in order to take along this bulletin.

As the only reliable handbook of the kind in the language, Bulletin No. 61 will be in wide request among those interested in forestry and lumbering. It may be secured by application to the Forester, Department of Agriculture, Washington, D. C.

The Gases Given Off by Actinium.

Solutions of radium salts are known to give off continually an explosive mixture, $H_2 + O$, resulting from the decomposition of the water under the influence of radium. Ramsay and Soddy have shown this mixture to contain also small amounts of helium, which, as is generally presumed, is due to the disaggregation of the radium atom.

Mr. A. Debierne, as pointed out in a recent memoir to the French Academy of Sciences, has performed a large number of experiments on a solution of radium bromide and on actinium salts both in solution and in the solid state, when a formation of helium was stated with both kinds of salts. The experimental outfit used was similar to the one employed by Ramsay and Soddy, the gaseous mixture being introduced into a glass tube containing different substances to absorb any gases susceptible of chemical reactions. Such gases as were not absorbed in one of these tubes, viz., those of the argon group, were compressed by means of mercury in a small capillary tube, about 2 cubic millimeters in capacity, and carrying two platinum electrodes. The spectrum of the gas was observed in a direct vision spectroscope of fairly great dispersive power, giving the wave length with an error of 1 or 2 units in the fourth figure. Photographs of the same spectrum were obtained by means of a quartz spectrograph, allowing the wave length to be measured with an error of one unit in the fifth figure.

The helium gas obtained in the author's experiments was found to be due to the presence of radio-active bodies as borne out by numerous checking experiments made under similar conditions.

In a previous paper, the author has shown that outside of the large amount of rapidly evolved emanation from actinium, there is a rather small amount of emanation which is evolved much more slowly. This latter emanation is found to be identical with the one given off by radium, though the amount evolved be extremely small.

It may be mentioned that Prof. Debierne has found in the spectra of the gases given off by actinium a number of lines which he has not been able as yet to ascribe to any one of the known gases.

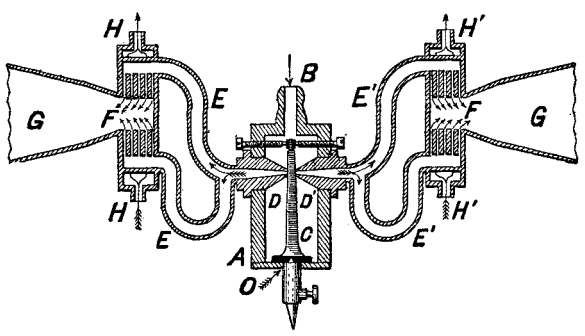
A NEW MEGAPHONE.

BY DR. ALFRED GRADENWITZ.

A novel apparatus for increasing the intensity of sounds has been invented by Messrs. G. Laudet and L. Gaumont. The principle underlying the construction of this apparatus, which was recently presented to the French Academy of Sciences, consists in transmitting the sound vibrations concerned to and from a convenient flame. After the first experiments made in this connection, utilizing the human voice, had given satisfactory results, the voice assuming a remarkable intensity, the experimenters continued their investigations, employing sources of sounds of mechanically determined intensity, with continued success.

The megaphone (shown in the accompanying engraving) consists of an equilibrated distributor to regulate the amount of the burning gas mixture, and a burner wherewith the gases are consumed in an ignition chamber. The apparatus submitted to the Academy was arranged for registering the reinforcement of sounds of any kind on ordinary phonograms. Air and acetylene were employed as burning gases.

The distributing mechanism consists of a chamber, *A*, into which the combustible mixture is introduced under pressure through a conduit, *B*. A vane, *C*, supported on knife edges at *O*, is mounted at the bottom of the chamber, *A*, an elastic ring being provided to insure airtightness in *O*. Any motion given to the pencil is transmitted to the vane, *C*, inside of the distributor. On either side of *C* openings, *D* and *D'*, are provided through which the gaseous mixtures are allowed to issue in respectively equal amounts as long as the vane is immovable. Any displacement of *C* will, however, result in an increase of the amount of gas issuing on one side, while the amount issuing on the other side is reduced. The total amount of utilized mixture remains constant, and the pressure in the interior of the chamber is also unaltered.



A NEW MEGAPHONE.

The gases are collected and conveyed to the burners through a series of conduits, *E*, *E*, *E'*, *E'*. The burners consist of a series of disks cooled by an air current, *H H'*, the gases being expanded and reduced to a temperature such that combustion always occurs in the chamber, *F F'*, just at the point where the gases escape from the openings of the burner. The apparatus further comprises two funnels, *G G'*. The power of the sounds obtained, which is truly remarkable, depends on the amount of gas mixture used and on the energy expended during its combustion.

The Current Supplement.

The current SUPPLEMENT, No. 1560, opens with a description of a 50-ton electric crane having a radius of eighty-seven feet. In a number of papers recently contributed to various scientific publications, Prof. Rutherford and others have made valuable contributions to our knowledge of the properties and life history of radium. These are reviewed in an excellent article bearing the title "Recent Study of Radium." Platinum and its alloys are briefly discussed. Prof. John J. Montgomery writes authoritatively on new principles of aerial flight. Walter J. May contributes an account of metal foundry patterns. Curious optical illusions are described by Arthur K. Bartlett, the chief being the halo of the moon. Mr. J. H. Morrison's excellent series of papers on the iron and steel hull steam vessels of the United States is brought to a conclusion. The last installment of A. Dastre's article on the stature of man at various epochs is presented. R. Kissling contributes the result of his recent investigations in the chemistry of tobacco. There are few more familiar sights than rain, and yet the method of its formation is but little understood by the ordinary reader. For his benefit the current SUPPLEMENT contains a most instructive article, in which the phenomena of rainfall are simply discussed. Prof. Dr. Hans Molisch, whose investigations on the phosphorescent light of plants have made him a leading authority on the subject, read a paper on "The Radiation of Light by Plants" before the Congress of German Naturalists and Physicians. This paper is published in full.

Engineering Notes.

In considering the proper material for a lagging, the principal elements are nonconductivity, noninflammability, efficiency, economy, ease of application, structural strength to withstand frequent removals and reapplication, freedom from corrosive agents, ability to withstand indefinitely the disintegrating effect of the action of heat, and the vibrations and concussions incident to locomotive action. In addition, the covering should be only of material which is of a porous or spongy nature, with numerous cells or spaces, which will retain air between the particles of the substance.

As an instance of the rapidly-increasing use of steam turbines in Europe, we may mention the following electric plants, which are either in construction or already running. The plants in question are all under the control of a Franco-Belgian syndicate. The first of these, and the largest, is the new electric station which is to supply an extensive section of Paris with current for lighting and motors. It is now in construction at St. Denis. The power of this station will reach nearly 30,000 horse-power, and an overload of 20 per cent can be kept on for two hours. Next comes the large electric plant of Sclessin, near Liège, which has steam turbines to the amount of 15,000 horse-power. The new electric plant of Charleroi, also in Belgium, can furnish 3,500 horse-power, while the new plants which are erecting at Brussels, Ostend, Maubeuge, and at Cairo represent in all about 15,000 horse-power. Thus we find that steam turbines to the extent of 65,000 horse-power have been installed within three years by the same company.

The question is sometimes asked whether it pays to reduce the pressure when the load is light. It hardly pays to reduce the pressure on the boiler, except in very extreme cases, but if it can be done by throttling before the steam reaches the cylinder of the engine, it would be an advantage, because this retains the heat units due to the higher pressure in the steam and the throttling has a slight superheating effect. As a matter of fact, tests made by Willans & Robinson, of England, go to show that for light loads and high pressure, a throttling engine may do even better than automatic cut-off. The ideal arrangement is to throttle the steam for light loads up to say near quarter cut-off, and after that, for heavier loads, allow the variable cut-off to come into play. This practice has been carried into effect by the design of Mr. E. J. Armstrong, in which he arranges the shaft governor so that there is negative lead up to nearly one-quarter cut-off, after which the lead becomes positive, and this has the effect of throttling the steam for the earlier loads and undoubtedly gives better economy, in addition to making the engine run more quietly.

The first tunnel which is to pass underneath the Seine near Notre Dame for one of the new sections of the Paris subway has now been commenced. The Metropolitan had been taken across hitherto upon two bridges. These latter sections have not as yet been completed, however. As to the tunnel under the Seine, the first of the caissons was sunk not long ago. It has the peculiarity that it not only serves in carrying out the work, like an ordinary caisson, but the superstructure forms the walls and vault of the tunnel itself, having straight sides and an elliptical arched top. So that it will be sunk on the spot where it is to remain and then will be covered on the inside by an envelope of cast iron and masonry. Each of the caissons thus forming a section of the tunnel is 130 feet long by 33 wide and 29 high. At this point the Seine has 16 feet depth. The lower side of the caisson will be sunk to a depth of 33 feet below the river bed and the upper part will thus lie about four feet below the ground. There will be three of these sections to form the tunnel which passes obliquely across the Seine.

In Switzerland, the number of electric and cable inclined railways for ascending the mountain slopes has greatly increased within the last few years, and when working in connection with the railroads, the system has proved very useful both for tourists and also for the inhabitants of the health-resorts which are placed at elevated points. Among the new inclines which are now in construction we may mention the one which is to be used for mounting the Wetterhorn. It is designed upon the Feldmann system, by the constructor of the well-known Barmen-Elberfeld-Vohwinkel suspended road. The peculiar feature of the new Wetterhorn incline is that the cars are suspended above the tracks upon cables. The overhead cable is made double and there are two cables, one above the other, so as to provide for breakage. The two tracks lie 25 feet apart and the cars are drawn as usual by cable. The descending car helps to draw up the ascending one. The sustaining cables are anchored separately at the upper part and at the lower are stretched by a counterweight. This makes the tension of the cables independent of the value and the position of the traveling weight due to the cars. Steel cables of about 2-inch diameter are used. The cars are very light, and the system takes less power than usual.

Correspondence.

Medical Students in Germany.

To the Editor of the SCIENTIFIC AMERICAN:

In the last number of the SCIENTIFIC AMERICAN you make the statement that "the overcrowding of the medical profession in Germany is a matter of grave concern." Allow us to correct this statement through the following statistics. The medical students in Germany reached the numbers stated below in the respective years:

1884-1885	7,844
1887-1888	8,513
1890-1891	8,163
1893-1894	7,740
1896-1897	7,785
1899-1900	7,022
1902-1903	6,232

—from which figures you will see that rather than increasing, the number is decreasing.

C. BISCHOFF & Co.

New York, November 10, 1905.

Soft-Ground Horseshoe.

To the Editor of the SCIENTIFIC AMERICAN:

I notice in your issue of the 28th instant a sketch of what you call a "soft-ground horseshoe," recently invented. This reminds me of an appliance used by my father during the 50's, on mules that were used for plowing and harrowing lowland rice fields on Clarendon Plantation, Brunswick County, N. C., on west side of the Cape Fear River, five miles below the city of Wilmington, N. C.

These lands are so soft in many places that horses or mules cannot walk across them without sinking. The boots, as we called them, were first made of heavy sole leather with wide, round bottoms, and extended up around the animals' fetlocks, where they were made fast with straps and buckles. These were a failure. When the leather became saturated with the water it would double up and not support the weight of the animal. My father then made them of wood—black gum—at much smaller cost, and used them for years with perfect satisfaction. He was the first planter to use them in this State, and I think in the South. There was no patent on them; all who wanted to made and used them. It was the only way that mules could be worked in many of the rice fields.

It was very amusing to watch the antics of a mule with his first "set of boots" on. The modern clog dancer ain't in it a little bit.

The mules intended for this work were fitted with the boots and allowed to loaf on the high ground until they became accustomed to their boots before they were put in the soft land. JOHN S. WATTERS.

Charlotte, N. C., October 29, 1905.

The Curious Behavior of an Incandescent Lamp.

To the Editor of the SCIENTIFIC AMERICAN:

While experimenting with a disconnected incandescent lamp bulb last week, I knocked off the tip to note the retarding effect of air on the vibration of its carbon filament, which thus remains active only 1-200 part as long as when in a vacuum. At the moment of the inrush of air, which in this case, due to the size of the puncture, was about a half second in time, I was startled by a shock like a current which passed through the hand grasping the brass terminals, which also continued for one-half second. The lamp was an old one, with a break in the filament, and I subsequently tried a dozen others—all old—to repeat the effect, but only once could another but slight current be perceived. The first lamp had for about fifteen minutes before been charged by an electrified belt, but of course again discharged, certainly absolutely, as must result by handling for some minutes, and therefore this was repeated in some of the tests made afterward. In both successful incidents it happened, therefore, that the lamps were subjected to the influence of static electricity. I had formed the theory that the electricity set free was due to friction of the air current on the filament and that whenever results were obtained it was due to the former striking the latter squarely and when this was nearly complete. The lamps used were of the double-loop kind and of 16 candle-power. The current was of an irregular, vibratory nature, which appears to presuppose that the trembling of the filament loop was concerned in the effect. In exact language, what was the cause of this electricity?

Brooklyn, N. Y. ALBERT F. SHORE.

Mosquitoes and Yellow Fever.

To the Editor of the SCIENTIFIC AMERICAN:

Does the *Stegomyia fasciata* die or lose its power on the fall of frost?

Does the *Stegomyia fasciata* lose its prepotency in intervals of years or months (*vide* the outbreak of fever at the towns in Nicaragua and Honduras)?

Is it not a fact that the mosquito is worse in cool or cold weather than in hot?

Where is the inceptive in yellow fever—in the man or the insect? Is there not a commencement?

Is it not possible for two or more gases, each innocuous, combined to form a third or fourth gas toxic?

If filth is no factor, why the preliminary cleaning up, at such a loss of time or money?

Does the difference in atmosphere between closed rooms and open beds play no part in the transmission?

Does receptivity of patient count for nothing?

Does the difference in the virulence of the attack under similar conditions amount to nothing?

Finally, is the *Stegomyia fasciata* more delicate than other species of mosquitoes? If so, what of the ovum—or the original fasci in the commencement?

Suppose an unimpregnated *Stegomyia fasciata* lives through the winter—is he capable of conveyance? His life is at furthest 120 days. In the cold, or semi-cold months, is he incapable of transmission? Does heat, moisture, or other unknown cause play no part? In other words, is the *Stegomyia fasciata* the *sole cause?*

I make no comment. I have lived in New Orleans and other Southern cities through fever epidemics; have noticed the bites in epidemics, and when there were none. Know, but will say nothing of the continuous activity of the mosquitoes. Make no postulate, but ask for information. WILLIAM F. WILSON, M.D.

Port Lanaca, Tex., September 24, 1905.

Automobile Notes.

To prevent the freezing of the cooling water for gasoline motors in temperatures down to 0 deg. F., it is advisable to mix with the water about one-quarter its volume of wood alcohol.

By his arrival in San Francisco at 9 A. M. on October 30, W. C. Chadeayne broke the transcontinental motor bicycle record of 48½ days, originally made by George A. Wyman. Chadeayne left New York Septemper 13, at 9.25 A. M., and taking into consideration the difference in time, he was just 47 days, 11 hours, and 35 minutes making the trip. The machine he rode was a Thomas "Auto-bi" with a belt drive. On account of snow and sandy roads, he was obliged to ride over the railroad ties a good part of the way during the last two weeks of his trip. He also rode several nights by moonlight in order to gain time. His experience at this time of the year was a particularly trying one, and both he and his machine deserve great credit.

The postal service is using a form of electric automobile mail wagon in Milan, and it appears to be quite an improvement. The new postal car, following the lines of the Paris system, which we illustrated not long since, runs between the central post office and the branch offices and boxes in the different districts of the city. The car is built by an Italian firm, but it differs considerably in construction from the Paris car, in the fact that the main part of the automobile is of large size, on the style of an omnibus, and is fitted out so that the mail can be sorted by the employe while the car is running. The car stops at each letter box to collect the mail, and between the boxes the employe sorts and stamps the letters and passes them in packages to a second man who puts them in a series of compartments corresponding to each postman's route. All the boxes are collected within an hour and a half, with a total run of 14 miles. It is proposed to extend the use of these cars all over Milan.

A new electro-chronograph for timing races has been devised by Mr. D. Owen, lecturer in physics at the Birmingham Technical school. The apparatus comprises a revolving drum which rotates at a uniform speed. The surface of the drum is smoked, and on it presses a style in connection with an electro-magnet which travels parallel to the axis of the drum as the latter revolves, thereby supplying a spiral trace on the drum. The electric circuit includes a target switch and a tape switch, which are united by a metallic lead and return wire. The starting pistol is fired at the target on the target switch, thereby opening the circuit and lifting the style momentarily from the drum. When the tape is reached and broken the same action takes place, and the number of revolutions of the drum between the two breaks is then read off. The timing of the speed of the drum is made electrically under the actual conditions of the race by placing the electro-magnet of the chronograph in connection with a pendulum or clock, which is made to give a mark on the revolving drum at intervals of one second. A ten-second race can thus be timed with certainty to one-fiftieth of a second.

The Bishop of Salisbury has lately adopted the automobile, and not long ago he was seen on his way to the assembly at Weymouth in his new car. Following his example, no doubt many other members of the clergy will take up the modern method of locomotion. One case we may mention at least. It seems that at Liverpool the members of the congregation have raised the sum of $6,000 by subscription, for the purpose of allowing their pastor, Mr. Chavasse, to purchase an automobile. This will enable him to visit the outlying parts of his district very easily. Among the sovereigns who have taken up the automobile lately is the King of Siam, who after taking his ministers around in a car over the rather rough roads of the country, has now made the purchase of a De Dietrich 16-horse-power chassis at Paris. Upon the chassis he will have mounted a special carriage-body according to his ideas. The Prince of Bulgaria, who does not hesitate to go in for all kinds of sports, even riding on the locomotives, is a fervent admirer of the automobile, and when last at Paris was often seen driving about the boulevards and parks.

The automobile appears to be making considerable progress in India and Indo-China. This was brought out in a striking manner by the great touring race from Delhi to Bombay over an 850-mile course. In Indo-China the cars are coming into use in many places, especially in the large cities. The wealthy residents of Kuala-Lampur, one of the principal cities of the region, lying toward the south in the state of Selangor, now own a number of cars and they are very popular here. But the greatest future lies in the direction of industrial cars. The region possesses large gold mines, also an abundant supply of iron and tin. The principal exportation products are spices and gum. But owing to the lack of railroads, which are difficult to construct, little has been done toward utilizing the riches of the country. Industrial cars are now being introduced in the region and they will no doubt be of great value. The De Dion-Bouton hauling car which takes a 1½-ton load has already proved a favorite and before long we may see many of them in use. Should a public service of automobiles be organized, this would bring about a considerable importation of rice, cotton goods, coal and oil, etc., into the region.

At a recent meeting of the Académie des Sciences M. D'Arsonval gave a description of a new device for observing the speed of a motor. This apparatus, which is simple and practical in its character, has been brought out at Paris by the Richard firm, the well-known instrument constructors. Unlike most speed-indicating devices, it is intended to show the variable change of speed which a motor may have from the normal at any instant, comparing it with the speed of a standard motor which has a uniform movement. The standard of comparison in this case is a clockwork device which is provided with a speed regulator, so that its movement is practically constant. A uniform rotation is thus communicated to a pair of friction plates mounted on a shaft and acting on a roller whose distance from the axis of the plates is regulated by a milled screw. The friction roller gives a greater or less speed to one of the wheels of a differential mechanism. The other wheel of the differential is operated by the motor which is under trial. By regulating the position of the friction roller by the hand screw we can bring the first wheel of the differential to the mean speed at which the second is running, and for the standard speed of the trial motor the two wheels of the differential will run at the same speed and the apparatus itself will then remain at rest. Variations of the trial motor from the standard speed are seen by an indicating needle which is placed on the movable part of the differential. The Richard apparatus in its present form is so designed that an angular displacement between the motor shaft and the clockwork shaft represented by 1-250 of the circle is shown by a movement of 0.12 inch of the needle upon the dial, but the scale can be read down as close as 0.02 inch. Such an instrument will no doubt be valuable in different kinds of testing work, especially as it is of simple construction and easy to operate.

Temperature and Weight.

L'Illustration (Paris) propounds and solves the following little problem in physics: Does any body whatever, warm, weigh as much as, more, or less than the same body cold? Note that this may have importance in the physics of the globe. The attraction between bodies which is shown in gravitation might change and vary. The ideal would be to be able to measure this attraction between identical bodies at very different temperatures; but the experiment can hardly be made, so an English physicist, Mr. Poynting, proceeded otherwise. He sought to see if a body whose weight we have taken in the scales at a given temperature preserves the same weight at another temperature, much lower or higher. The experiment is delicate and demands great care. It showed that the solid body heated to more than 100 deg. C. is a little lighter than the same body at 15 deg. The difference is very slight—0.003 milligramme in a solid of 208 grammes weight. In a general way, the difference in weight is not even as 1 to the tenth power of 10 for a difference of one degree in temperature. The difference exists, but it is infinitesimal. During the heating or the cooling of the body experimented on, there occur pretty considerable (apparent) variations in weight; but this is ephemeral. The heated body, which at first seems to lose a pretty important proportion of its weight, recovers the greatest part of it and shows itself, once heated, to have a weight only very slightly inferior to that which it had at low temperature.

THE ORINOCO—A WASTED WATERWAY.

BY G. L. M. BROWN.

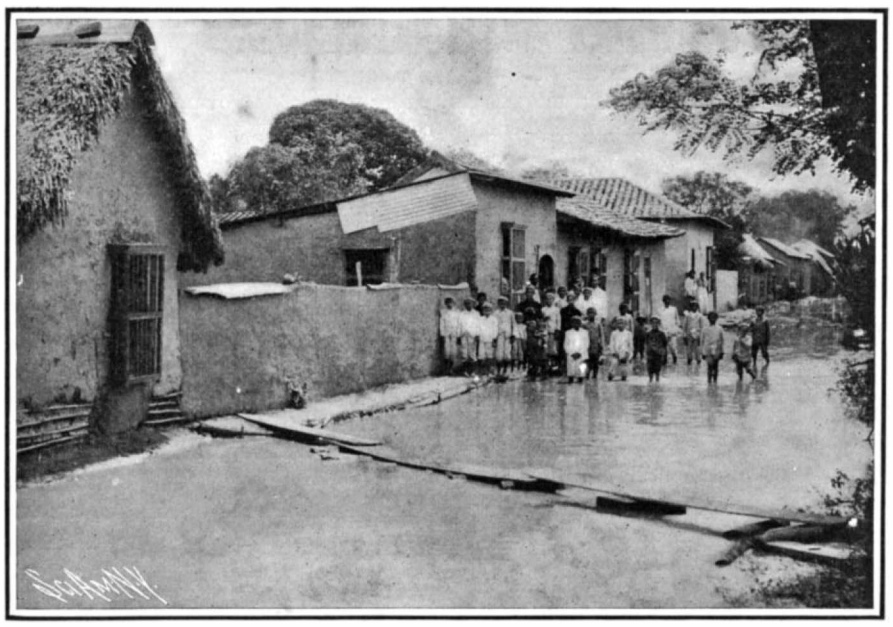
Of all the great rivers of the world, with the exception, perhaps, of the Zambesi and, of course, those emptying into the Arctic Ocean, the Orinoco is the least known to commerce. Less remarkable for its length than its volume, in which it is exceeded by only eight other rivers, it has half a dozen tributaries compared with which the Susquehanna or the Potomac are mere pigmies, and drains a territory of 360,000 square miles, more than half the surface of Venezuela, or equal to the combined area of Italy, Spain, and Portugal.

Its actual length is estimated at 1,450 miles to its source in the sierras of the mysterious Guiana region; but to the head waters of the Guaviare, one of its upper branches, the distance is perhaps 1,600 miles or more. This tributary is about the size of the River Loire in France, but the Meta, the Arauca, and the Apure—the latter of which is regarded by some authorities as the true upper course of the Orinoco—all exceed the far-famed Rhine both in length and in volume, and in the rainy season roll down a vast flood such as few rivers of their size have ever been known to discharge. The Orinoco itself averages more than twice the volume of the Danube, and could gain or lose a dozen Hudsons without appreciably affecting its regular rise and fall. On the other hand, it must be remembered that two rivers on the same continent greatly surpass it both in length and volume—the La Plata and the Amazon, the volume of the latter being estimated at six times that of the Orinoco.

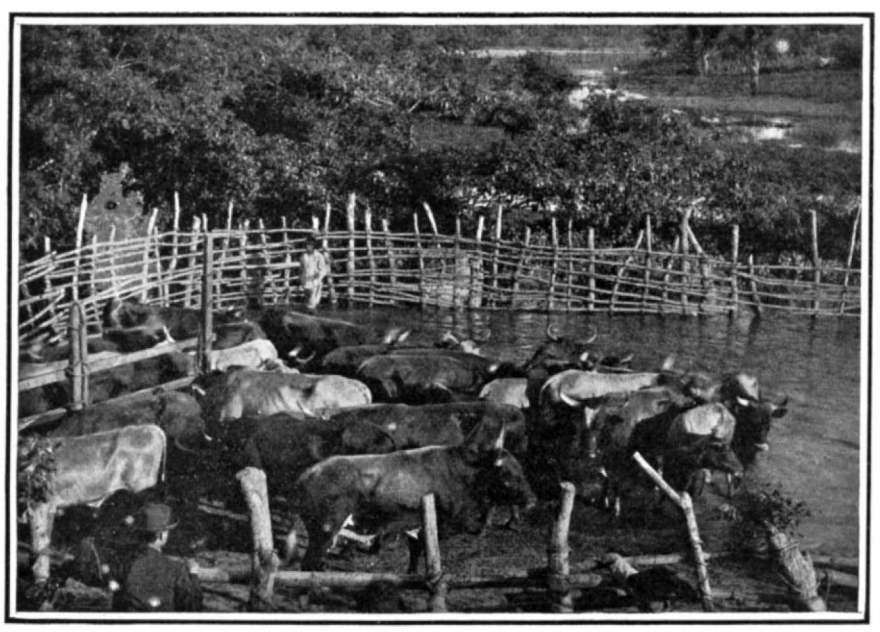
Apart from its size, the Orinoco is remarkable for several peculiarities, notably for its communication with the Amazon system through the Cassiquiare, which, it may be noted here, is not the sluggish canal at one time described, but a swiftly flowing river which divides its waters in the ratio of two to one, the Orinoco receiving the lesser current. The famous delta with its thirty-six channels is also an interesting feature, though less unique than the inland delta formed by the Arauca and the Apure where they join the main stream. This has been caused by the enormous force of the "winter" floods, which break through the soft mud banks, forming a confused network of "caños," or channels, which relieve first one and then the other of the streams they so intimately connect.

Like most rivers that flow through vast alluvial plains, the Orinoco is wide and shallow, and contains many shifting sand-bars which hinder the summer navigation; but this is not true of all of its course, for hills of blackened granite are seen at places with here and there a huge boulder projecting above its muddy surface. At the port of Ciudad Bolivar (formerly Angostura) the river is so constricted that it attains great depth, and in the wet season sweeps through its narrowed channel with such force that "lanchas," or sailing barges, have sometimes been known to take a week in passing this point. Its average rise at the narrows is between 40 and 50 feet, but in 1892 it attained the incredible height of 75 feet above low-water mark, and actually flooded the city, which in the dry season is perched high on the hillside, making a prominent landmark for approaching vessels.

The Orinoco is navigable at all seasons from the Atlantic (including seven of its mouths) to the Atures rapids, a short distance above the mouth of the Meta. A special class of steamer has to be used, of course, for this up-river navigation, and the vessel in the accompanying illustration will serve as a type of all the steamers plying west of Ciudad Bolivar, except one recently added to the fleet, which is an exact copy of the boats of the upper Nile, and draws just twelve inches. This latter is designed for the river Meta, the navigation of which has heretofore proven difficult for boats drawing three feet or more, except in "midwinter" (i.e., July and August), when it is easily navigable to the edge of the Colombian highlands. The Arauca presents conditions similar to the Meta, and receives one steamer during the rainy season, which ascends to the village of Arauca, situated on the boundary between the two republics. The Apure, however, has a more uniform course, and is said to be navigable for more than 600 miles; but regular steamers certainly do not ascend that distance, the traveler being fortunate if he can get comfortable passage above San Fernando. Even this important town is frequently isolated during February, March, and April, as the writer learned to his dismay on his arrival from the Llanos. The stranger, to be sure, will suffer no great hardship by the delay, since the town contains many well-appointed stores and can boast of an ice factory, a Chinese laundry, a small daily bulletin containing foreign cablegrams, and for his entertainment a primitive bull-ring! But even these attractions and the charming hospitality of the people pall upon him, and he constantly watches the sluggish current, hoping against hope that a rise may occur. Fate was kind in the writer's case; a tropical storm in the far-distant Andes gave the necessary increase, and the town, one morning, was awakened to activity by the whistle of a small stern-wheeler which carefully felt its way over the bars, and crept in to the bank. Six months later, I reflected, as I watched this diminutive craft, the greatest vessel afloat could be made fast at the selfsame spot, and the ground on which I stood and, indeed, perhaps the whole town, besides countless leagues of savannah, would lie several feet below the onrushing flood.



A Scene in San Fernando During the Rainy Season.



Live Stock Ready to be Shipped to Trinidad.

A short distance above the Atures is another rapids, the Maypures, these two forming the only obstruction to the navigation of the Upper Orinoco, the Cassiquiare, and thence through the Rio Negro to the Amazon, as well as of the Guaviare, already mentioned, which drains the vast and otherwise inaccessible region southeast of Bogotá, and is said to be navigable for 500 miles.

The navigation of these waters was attempted about fifteen years ago by a French company which had acquired valuable rubber concessions in the region of the Cassiquiare and the Rio Negro (known as the Rio Negro district), where extensive forests of the very finest Pará rubber exist. The company, at great cost, transported a small steamer in sections to the foot of the rapids, and thence overland to the Upper Orinoco (their intention, I believe, was ultimately to build a connecting railroad here), launched the vessel, and began to exploit these priceless forests. Unfortunately, however, as has been the case with so many French companies on this continent, the project failed through gross extravagance and mismanagement, and the little steamer was soon abandoned to the mercy of the floods. The present "Orinoco Line of Steamers," who own or control all vessels on the entire Orinoco system, informed the writer that they intend repairing this boat and encouraging trade with the upper river; but until this is done, we have the astounding spectacle of more than a thousand miles of navigable inland waterways undisturbed except by an occasional canoe or lancha.

The lancha is simply a light scow, or flat-bottomed boat, fitted with a single mast, from which, however, an enormous sail can be spread. With the summer trade-winds blowing from the Atlantic, good progress up-stream is often made, but for the return trip the mast and sails are stowed away, and the force of the current is depended upon, aided in the dry season by the use of poles or oars. If the westerly winds have set in, of course, it can sail back as well, and at times a little craft may be seen with sail set, tacking down stream in the teeth of an easterly wind; but this is sorry work. On my trip from San Fernando de Apure, indeed, we picked up a passenger from a lancha hailing from the town of Arauca, who informed me, with no little disgust, that the voyage had already lasted two months, and Ciudad Bolivar was still far distant. The lancha, if I remember correctly, reached port just two weeks after we did, and, of course, by no possible good fortune could the owner sell his little cargo of hides so as to make the trip profitable.

Speedier and more picturesque than the lanchas are the "bongos," or large dugouts, one half of which is sheltered by a wicker or palm-thatched canopy; and a sight never to be forgotten is the passing of a bishop or faithful "padre" with his Indian boatmen, making a round of parochial calls requiring, perhaps, several months' almost constant travel. The instant this craft is recognized, the steamer or lancha slackens speed, and when the padre glides alongside he solemnly blesses the voyagers, then thankfully accepting such contributions as are offered him, and exchanging a courteous farewell, resumes his solitary way. His garb, his half-naked boatman, and the primitive bongo make the traveler wonder for a moment if he has not beheld a vision of

The Narrows at Ciudad Bolivar.

early colonial days when the hardy fathers fearlessly set out to plant the cross in the remotest regions of the interior, and a glance at the shore line of tangled primeval forest and the still, lifeless track of waters in his wake, almost confirm him in the strange fancy.

The history of the navigation of the Orinoco is a sad recital of government monopoly and official corruption. The only port open to foreign vessels is the city of Ciudad Bolivar,* a restriction that has wrought untold hardship to mining and trading companies, who often lose on the extra transportation to and from this city the small profit necessary for the working of their concessions, and innumerable enterprises have failed owing solely to this short-sighted policy. The exclusion of all vessels but those of the river fleet from the Macareo channel of the delta, the shortest and safest route to Trinidad, is equally absurd; but these abuses are insignificant compared with the absolute monopoly of the up-river steam navigation, which is in the hands of the company already referred to, the "Orinoco Line of Steamers," who are the successors of the famous Orinoco Steamship Company, an American firm which was accused of aiding Gen. Matos in his ill-fated revolution, and was promptly snuffed out by President Castro. The nominal owners of the present line, indeed, are likewise an American banking and trading house at Ciudad Bolivar, but the president is a silent but very aggressive partner, and dictates the policy of the company, which, it is needless to add, is extortionate in the extreme, as are all other enterprises, controlled by him. To the credit of the American management, however, it must be admitted that an excellent service exists between Trinidad and Ciudad Bolivar, and that at least something is being done to better the communication with up-river points.

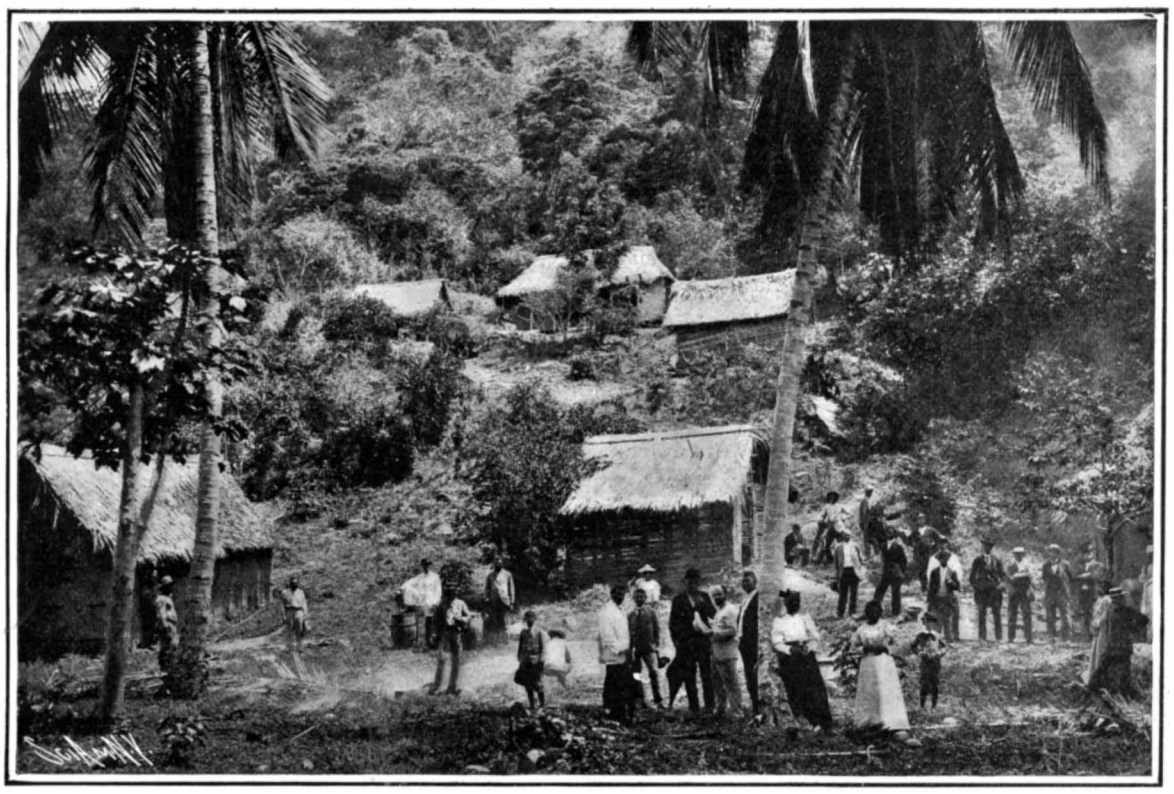
The outlook, however, is not very promising, and it is doubtful if the Orinoco country will be properly opened up during the present generation unless a radical change of administration takes place. Its population to-day is believed to be actually less than it was nearly four centuries ago, when the Spanish explorer Ordaz ascended to the mouth of the Meta; and the Indian stands in such fear of the Venezuelan and his government that he frequently prefers to follow the smaller waterways of the Guiana region, or take overland trips through the virgin forest rather than use the broad highway that is his rightful heritage from countless ancestors.

This disappearance of the Indian has greatly impeded the gathering of rubber, tonca beans, and other natural products, and since immigration is not encouraged and continuous revolutions have scattered or killed the settlers of European and mixed descent, it would seem that the country is steadily retrograding. There is a project on foot at present to establish a colony of Boers upon the "llanos," and Gen. Castro is said greatly to favor it;* but the Venezuelans assert that this is because he sees a chance to augment his army with tried fighters, not because he favors foreign colonization.

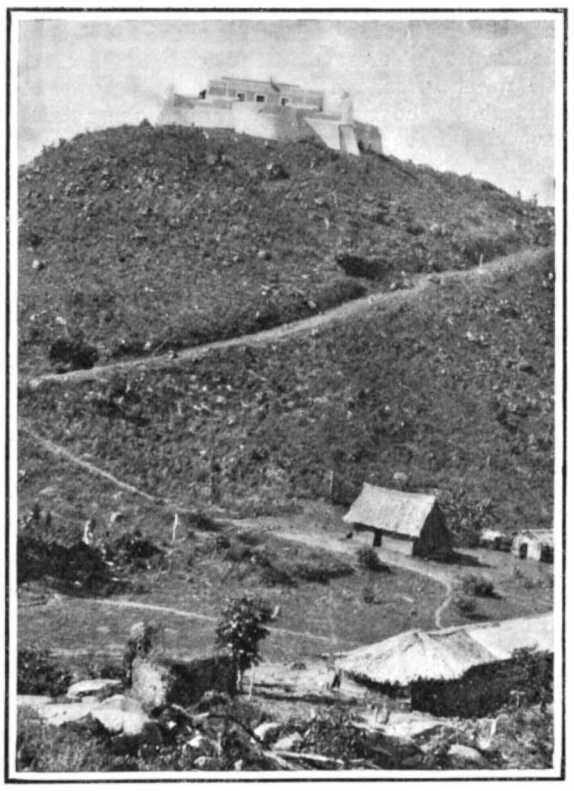
The writer sailed 200 leagues down this giant waterway, and was amazed at the primeval condition of the country. Between San Fernando and Ciudad Bolivar, which are about the same distance apart as are Minneapolis and St. Louis, it is estimated that there are less than 2,000 permanent settlers, apart from the inhabitants of Caicara and one or two other small villages. Most of these settlers, moreover, live among such wretched surroundings that one wonders that they find life endurable. The only evidence of modern progress that I witnessed during the entire trip was a windmill, and of the various craft we sighted not one was propelled by steam.

Yet the natural wealth and fertility of this region is boundless. The cattle of the llanos, as is well known, yield the finest hides that the shoe manufacturer can procure, and with cheap river freights, the traffic in hides from San Fernando alone should employ a fleet of steamers. During my visit to that town, however, the cattle industry was so depressed that animals on the hoof brought only $5. The rubber forests of the upper Orinoco are as yet almost untouched except on the margins of the streams, and the valuable balatá rubber, which is comparatively new to commerce, is found at various points from the delta to the Rio Negro. Hardwoods of an infinite variety, dyewoods, medicinal plants, vanilla, tonca beans, turtle oil, and alligator and crocodile skins, will all in time become important exports, as will rice, sugar, tobacco, cacao, and many other agricultural products when the land is taken up and cultivated.

To-day, however, the Orinoco country remains a veritable wilderness, and the Orinoco can best be described as a wasted waterway. Were it not for the attractive little city of Ciudad Bolivar and the enterprising town of San Fernando de Apure, one would not hesitate to call it one of the most backward territories of its size

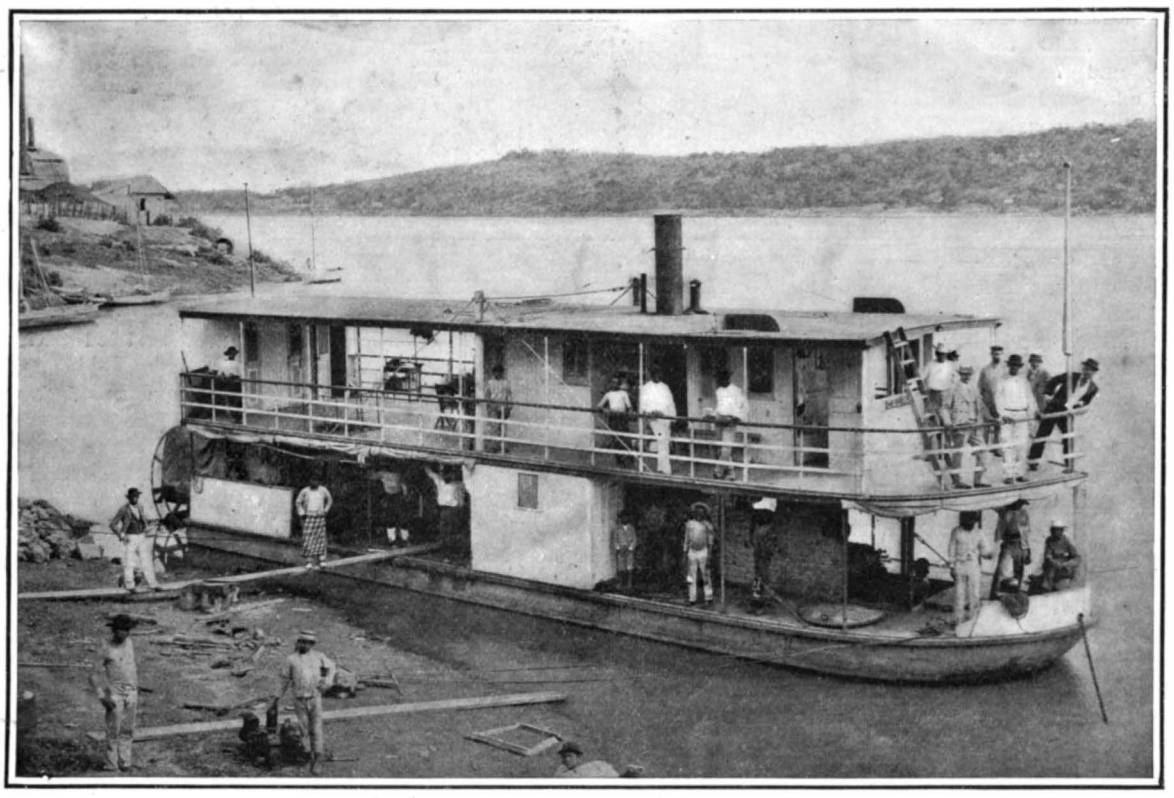


Among the Hills on the Banks of the Orinoco.



The Ancient Fortress of San Feliz.

Carib Indians of the Lower Orinoco.



A Typical Upriver Steamer.

THE ORINOCO--A WASTED WATERWAY.

* A small town near the Delta has recently been declared a port, but its position favors only the shipment of cattle.

* Gen. Pierson, the Boer representative, who recently returned to South Africa, states definitely that plans are completed to bring 8,000 Boers to Venezuela not later than 1906.

in the world. Yet the climate is healthful; the forest, mineral, and agricultural resources are limitless; and the whole region, with the exception of the highlands and sierras of Guiana, is rendered easily accessible by a magnificent river system. The only drawback to its development is the corrupt and inefficient government of Caracas—a drawback, judging by the past decades, that seems destined to outlive the century.

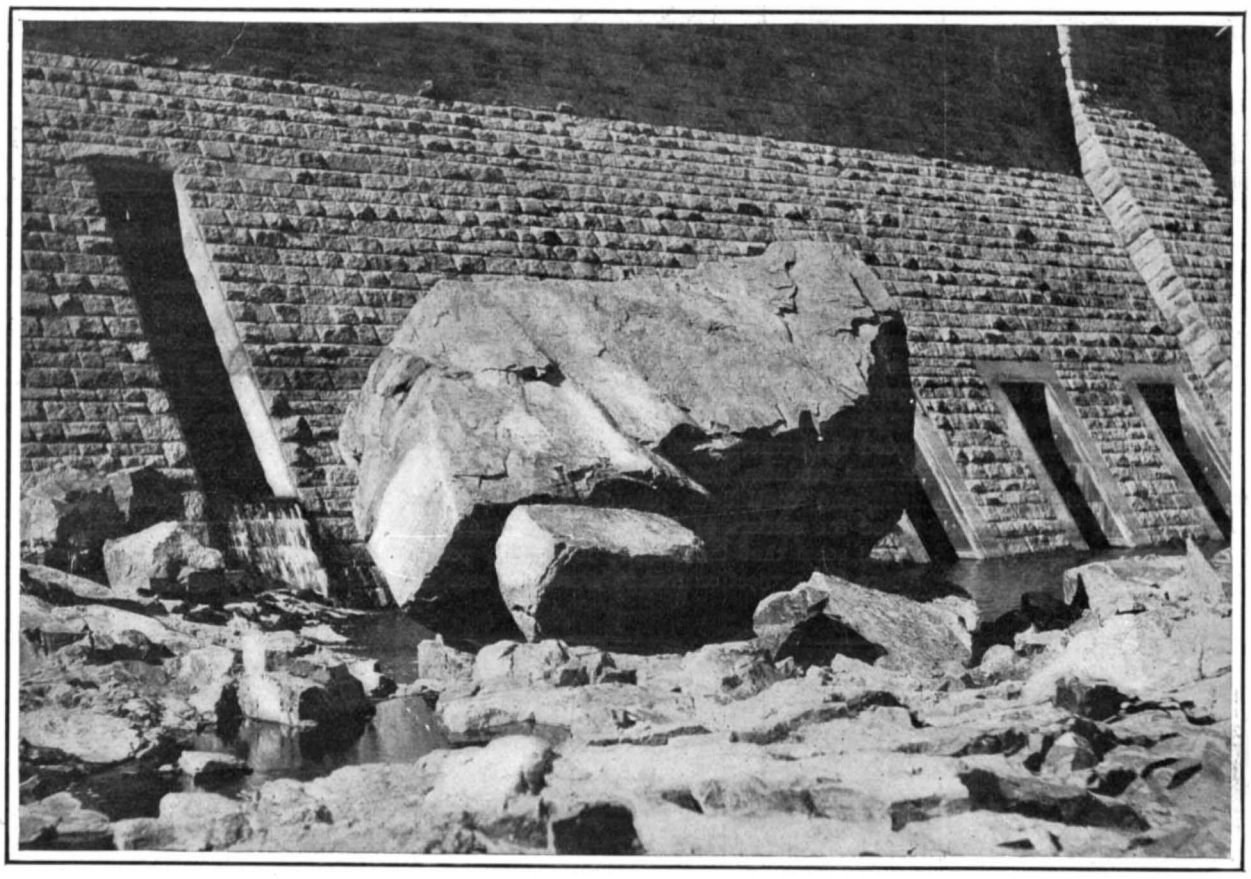
EXTRAORDINARY EFFECT OF WATER EROSION CAUSED BY THE ASSOUAN DAM.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

One of the most perplexing problems to the engineer, when dealing with the control of large masses of water, is the liability of erosion arising from the discharge of the water through a limited space. Occasionally the nature of the surface upon which the released water pours under great pressure and velocity is rugged and broken. Should a crevice exist the checking of the released water thereby is accompanied by a violence almost explosive in character, and the effects of this erosion are often of a remarkable nature.

One of the most extraordinary examples of this action is that shown in the accompanying photograph, kindly loaned to us by Sir Benjamin Baker. In this instance the rush of the water through the sluices of the Assouan dam has dislodged a huge bowlder from the rocky bed of the river. As is well known, this barrage extends right across the Nile just above the first cataract, and the flow of the river below Assouan is completely controlled by this dam, the water passing through a series of sluices. At times a huge volume of water is banked up behind the barrage to a height of 60 feet above the level of the down stream. The sluices, however, are built at different levels in the barrage, so that it is possible to control the velocity of the discharge. The maximum head of water allowed is 29.5 feet and this enables the velocity of the released water to be controlled within 36 feet per second.

The bed of the river is solid rock, yet the rush of the water has dislodged this huge piece of rock measuring 17 feet long, 12 feet wide, and 7 feet thick, and has thrown it against the masonry face of the dam. The weight of the bowlder Sir Benjamin Baker estimates to approximate 60 tons, yet it has been torn from the rocky bed and hurled backward by the water with the greatest ease.



THE EXTRAORDINARY EFFECT OF WATER EROSION CAUSED BY THE ASSOUAN DAM.

An Inventor's Fantasy.

BY T. A. REEVES.

I have always been fond of inventing. There is no pastime more fascinating and satisfying to my mind. Others may while away tedious hours with books or cards; but I enjoy a stimulating and unfailing pleasure in fixing my mind on some problem of mechanics, or some of the infinite possibilities of contrivance, and while I am engaged upon it the time speeds away on lightest wings.

Sometimes it is a long railway journey which is thus beguiled and shortened. Sometimes it is one of those irksome half-days of waiting which fall to one's lot in making connections at some cross-country junction, in the midst of a wilderness of scrub-oak; or at some tiresome country tavern, with nothing but the neighboring blacksmith shop to afford relaxation or interest!

Under such circumstances the hours have no horror for me. I seek a quiet corner, and open my design book at some rude sketch of a mechanical idea, and am soon lost to the dullness of the situation, to leaden-footed Time, and to every other annoying circumstance. I have even allowed a slow train to pass the station, while I continued at my problem and awaited a later express.

In the case of sickness, and the necessity of watching and carefully administering medicines, or rendering other attentions to the patients by night, it has been no trouble for me, with an interesting idea revolving in my mind, to remain awake, and to care for my loved ones. And often, when wakefulness possessed me, and sleep refused to be wooed, I have composedly resigned myself to the situation, ceased fretting and tossing, and taking up one of my varied inventions, either quieted myself to slumber, or forgot the worry of wakefulness in the delight of its pursuit.

One of the happiest of these devices, over which I spent far more time than the simplicity of the article would seem to demand, was "The Elastic Metal Band." It was intended to replace the rubber band which is so unsatisfactory from its rapid deterioration. The lawyer, author, or business man takes from pigeonhole or desk a package of papers, or the lady a dainty bundle of letters from her secretary, only to find its rubber band as brittle as clay, and perhaps stuck fast by warmth and moisture to the documents or missives which it bound.

My problem was to create a strap or band which should be perfectly flexible, and at the same time reasonably elastic. If it would stretch one-third its length and return, it would answer every practical demand. Its links must freely move, and there must be no rough ends or open joints to mar the appearance of the strip. It must be flat and neat, and then, when nickeled or plated, it would be an attractive and desirable article.

The attainment of all these features gave me no end of trouble. The pesky thing would tangle and hitch in the most unexpected and contrary ways! When adjusted around a bundle and automatically clasped to one's great satisfaction, on turning the bundle over there would be half a dozen links fouled and crinkled into an obstinate knot, that tried patience almost to the parting point.

I am myself a man of correct language. I do not swear, never having practised, or even learned the rudiments of that accomplishment. When my temper is tried to the last notch, and the expletives seem bound to come as a relief to the pressure within, I simply assure myself that there is need of more thought. Another difficulty has shown itself which must be overcome. If it had been easy to construct this article, it would not have waited for me, but would have been on the market, doubtless, long ago; and some other man, of less patience than myself, would be enjoying the fruits of it. With these philosophic and moral reflections I usually put the article away until with fresh mind it can be taken up again; or, as indeed sometimes happens, until at some unexpected moment the mind, dwelling unconsciously upon the difficulty, flashes out its solution in a moment of inspiration and almost superhuman insight.

Such was the point reached in designing "The Elastic Metal Band." It had been laid aside for a considerable time, as presenting almost insuperable difficulties; when one night I seemed to awake from a refreshing slumber. Never was my mind clearer or keener in grasp of mathematical or mechanical problems than in that hour. I glanced at my clock upon the wall, which I had designed, showing in phosphorescent figures the time, 2:45 A. M. Immediately the elastic band came into my thought, and was pictured before my imagination as vividly as if I held it in my hands. And what is still more to the point, the solution of the difficulty of the entangling links presented itself to my attention. I could join them so that the crinkling would be avoided absolutely; and the band was in one moment perfected, practical, and complete.

It would be difficult to describe the exultant feelings and triumph of that hour! It was almost a wild joy to have won the victory over all the perplexing obstacles which had arisen, and to see the pretty band of steel, with its ingenious curves, lying like a lady's bracelet, so artistic and beautiful before me! I felt that it would mean fame for me. And there was the genuine usefulness of the invention! It would fill a real want, and obviate the inconveniences of the imperfect article which it was intended to supplant. I saw the windows of the stationers filled with varied and exquisite designs of the elastic metal band; and offices equipped with an abundant supply, on the tables and desks and in the filing cabinets of lawyers, bankers, shippers, merchants, and manufacturers. The government would undoubtedly require immense quantities of these bands in all its offices. And I thought of the vast market for this indispensable novelty in the great cities and in every town and home in our broad land.

I will not deny, also, that golden visions came into my mind of rich pecuniary reward to myself from this important invention. I had before, when the article seemed ready to be patented and manufactured, consulted with a friend who was in the novelty line; and he had named a figure which seemed to me to be very conservative and safe on his side for the invention, and a very modest royalty after the manufacturers had reimbursed themselves for their outlay. But after all, it was a very snug sum in my circumstances; and there was the certainty that the royalty would surprise my friend when the orders from the whole country began to tax the capacity of his works! In the meantime there was an investment right at hand, in a neat row of cottages, suitable for the skilled mechanics of our city, which would bring a good 10 per cent on the whole sum, while I would have an unexpended part of it still in hand for personal use.

These golden visions filled my imagination with intense satisfaction, until my silent alarm, which was my own invention, awakened me by blowing a current of cool air upon my face; and with returning consciousness I realized that the difficulties were not yet fully solved, which barred from completion "The Elastic Metal Band."

Violet and Ultra-violet Rays Given Off by Metals at Ordinary Temperatures.

Those who have seen a winter night in the North will probably remember the brightness of the landscape even though the sky be covered with thick clouds. This phenomenon suggests the hypothesis that the snow has some luminosity of its own, and this problem is treated by Prof. Melander, of Helsingfors, in a recent paper published in Annalen der Physik.

After experiments made with a photographic camera imbedded in the snow failed to give any satisfactory results, the author eventually observed a very striking photographic effect of the snow cover. As, however, the photographic plates were covered with metal plates, Mr. Melander thought it necessary, first of all, to ascertain whether these did not exert any effect of their own.

Experiments made in this direction showed all metals to give off violet and even ultra-violet rays even at ordinary temperatures, though these rays are too weak to be noted by our eyes. As the temperature increases, this radiation becomes more and more intense until even our eyes are affected by it at a white heat. This radiation is possibly produced by certain chemical processes which occur at the surface of the metal, though the effect on sensitive plates seems to be due immediately to the surface rather than to any emanation.

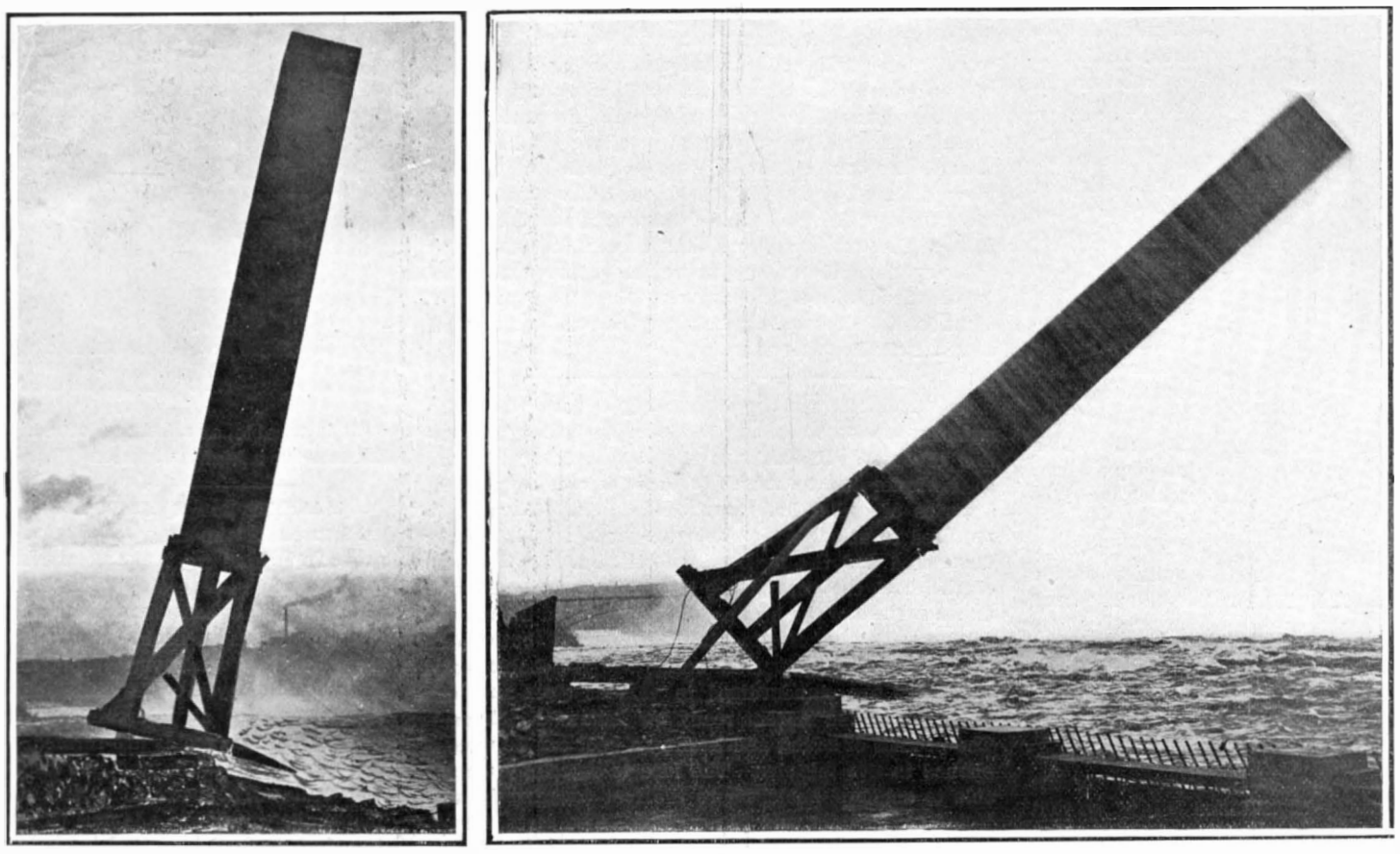
The ionizing power of these rays may play an unthought-of part in nature, and the author suggests that such animals as see in the dark may have eyes especially sensitive to them.

THE FELLING OF THE CONCRETE COLUMN AT NIAGARA.

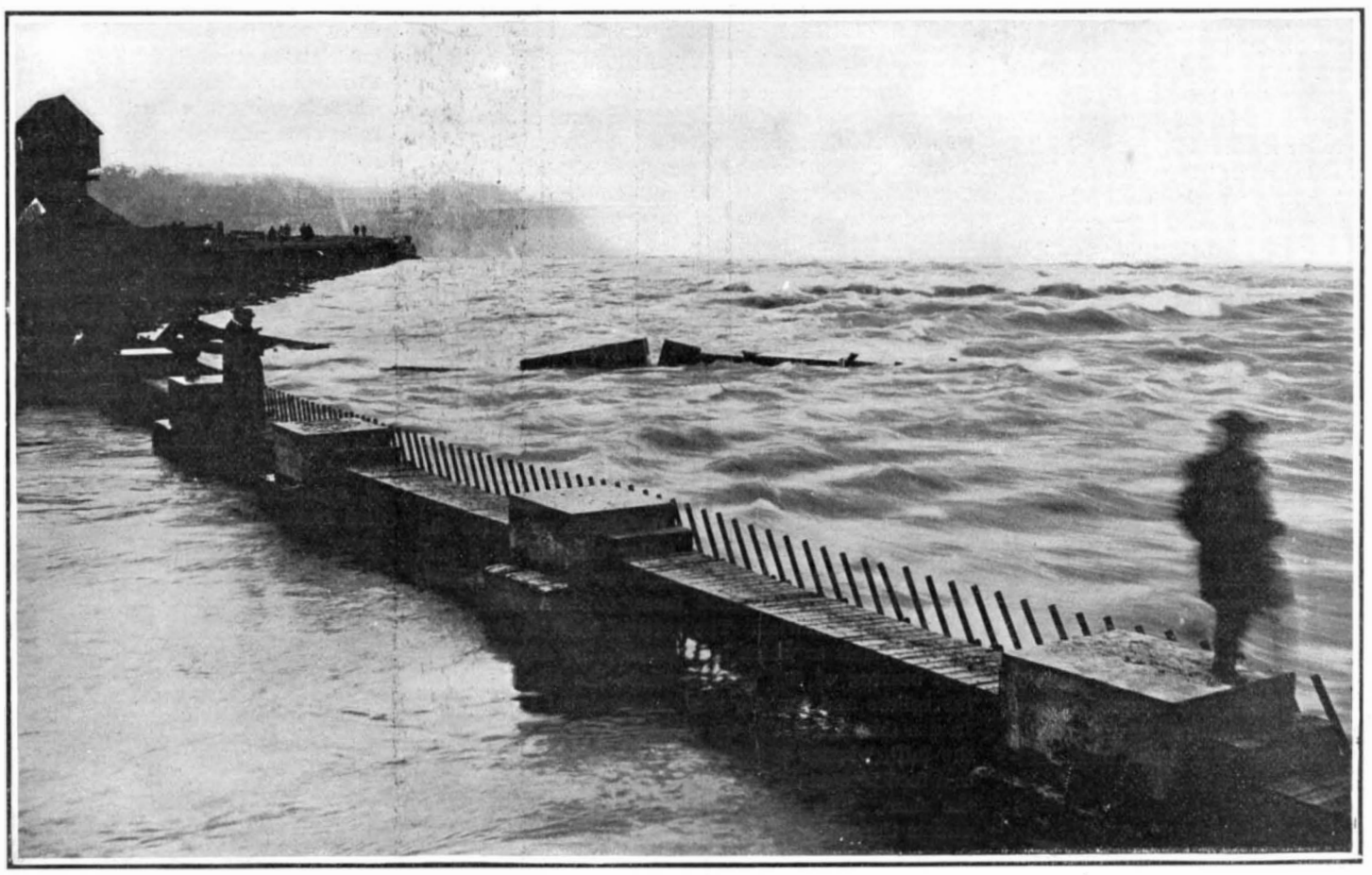
BY ORRIN E. DUNLAP.

The concrete column erected in Victoria Park, Canadian side, at Niagara, designed to make a dam in its prostrate form, was successfully tipped over into the river from the trestle on which it stood on the afternoon of Thursday, November 9, in the presence of between one and two thousand spectators. The trestle on which the column stood was 20 feet high above the ground level. The column was 50 feet high and 7 feet 4 inches square. Every 8 feet of its height a wooden wedge 12 inches thick at the outside and tapering to 6 inches at the center of the column was inserted for the purpose of breaking the column into sections when it fell, while a chain ran through the center of the column to hold the sections together when the column broke.

It required about an hour and a half to tip the column. Three jacks were operated under the timbers at the base of the trestle. For the first few inches of elevation of the timbers, hardly any slant was visible in the column, but soon the great shaft was seen to incline toward the river, and it was felt that it would fall very soon, but almost unexpectedly it toppled over into the river with great rapidity, making a mighty splash. The ends of the column disappeared under the water, but at the center the broken blocks or sections were elevated, but may settle down later. The trestle was intended to fall with the column for the purpose of throwing the inner end of the column about 15 feet out from the shore in order that an ice run might be left between the shore and the end of the column. This worked successfully. After the column was in the river the water in the intake was increased 10½ inches in depth, which it is believed will give sufficient depth to afford a full supply to the pumping station of the city of Niagara Falls, Ont., and the Niagara Falls Park and River Railway for power purposes, as the intake is used jointly. Supt. James Wilson, of Victoria Park, states that the results obtained are satisfactory, and he reports Engineer Isham Randolph, who planned the tower-dam, as being well pleased.



Tipping the Concrete Column Into the Stream. Two Views Taken One After the Other.



The Column in the Stream—Broken Into Segments in Accordance with Its Designer's Plan.

THE FELLING OF THE CONCRETE COLUMN AT NIAGARA.

A well-made maple wheel may be run with safety at a rim speed of 154 feet per second.

Sea-Gulls as a Commercial Asset.

In the immediate vicinity of the small town of Liegnitz, in Silesia, lies the village Kunitz, which is the proud possessor of a small lake, having a rush and reed covered island nestling cozily in its bosom. This sheet of water has been selected by a shrewd gentleman as a breeding ground for sea-gulls, and thousands may now be seen there. This idea was inspired not only by a poetic spirit, but also by a sound commercial mind, as the eggs of these birds are held almost in as much esteem as those of the lapwing or pewet as a dainty. The demand is so large, and the quantity of eggs secured is so considerable, that the gentleman in question is making money quickly, although he has to pay a rent of no less than $3,000 per annum for the use of the lake and island.

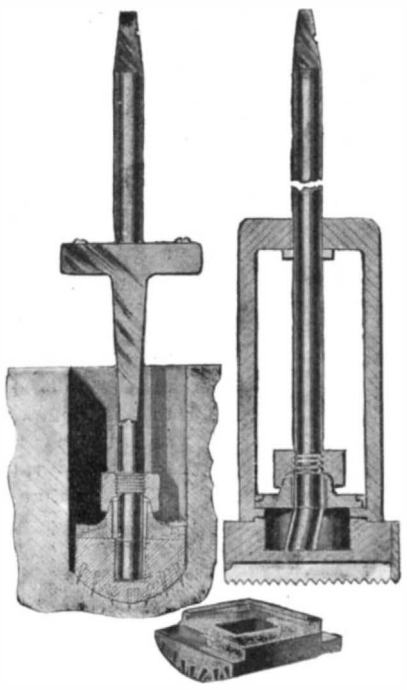
Strange to say, the birds have not been frightened away from the island by the regular collection of their eggs. This may be due to the fact that the owner allows no one but himself to set foot upon their domain. They do not seem to object to the removal of their eggs, but lay all the harder to make up for the loss—at least so it would appear, as the gatherings are increasing from year to year. At the same time the number of gulls is steadily advancing, a circumstance which is already giving rise to apprehensions, as the lake is getting too small to feed and accommodate them. Most gulls would, doubtless, at once recognize the necessity for emigration to other less overpopulated islets; but the gulls of Kunitz think otherwise. As the water of the lake is now incapable of providing all they need, they have decided *pro tem* to seek what they require in the neighborhood; and the visitor, on arriving at Liegnitz railway station, is much astonished to see (provided, of course, his advent takes place by day) flocks of these beautiful white navigators of the air come swooping down around the train in search of biscuits, buns, or what not, while thousands of others sit preening their feathers upon the roofs of the sheds, offices, and other station buildings. However, they have still other ways of getting a living, this being merely a kind of sportive branch of their victualing department. The real and true struggle for existence commences directly the peasant puts his hand to the plow, and turns up from the warm earth thousands of fat, juicy worms, beetles, earwigs, and other delicacies for which competition is as keen among the gulls as buying and selling are among men though the methods of the stronger gulls are often sharper and sterner — yet perhaps in the end the more merciful of the two. They follow the plow in their thousands, picking and scratching up the rich, brown earth, and collecting (to the farmer's great delight) myriads of insect for themselve and their hungry little ones. To watch them at work, it would be hard to believe that they were aquatic birds, so kindly have they become at home with Mother Earth as the source and origin of their supplies. Were it not for their peculiar and characteristic flight, and for their great number, the stranger might easily assume that he was watching some gentleman's private collection of white ravens.

A bridge of unusual dimensions has lately been constructed at Vauriat, in the Puy de Dôme, on the western side of the high plateau country of Auvergne. It carries a single line of railway over the river Seoule by three lattice girder spans, the central one being 472 feet 6 inches and each of the two side ones 377 feet 5 inches long. The two river piers of granite masonry are each 303 feet high, and tapered from 76½ feet × 43 2-3 feet at the bottom to 69 × 18¾ feet at the abutment level.

Patent Department

TOOL FOR BORING RECTANGULAR HOLES.

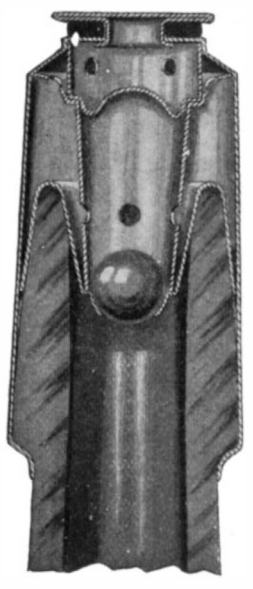
A decidedly novel tool has just been invented, by which a hole may be bored having square or rectangular walls. The accompanying illustration of the tool clearly reveals its construction. A frame is provided, which is designed to be held rigidly in a lathe or the like. This frame comprises two arms which, at their upper ends, terminate in cross bars. The overlapping edges of the latter are riveted together, and they are formed with an opening which provides a bearing for the rotary spindle of the tool. The head of the tool is pivoted to the frames by means of trunnions formed at the ends of the arms. This head, as shown in perspective in one of our views, is formed with a rectangular recess of greater length in the line of the trunnion bearings. The recess is adapted to receive the lower end of the rotating spindle, which it will be noted is bent, so that as the spindle rotates, the tool head will be given a rocking movement on the trunnions. As a bearing for the lower end of the shaft, a plate is secured to the top of the head by means of angular flanges. The flanges on two sides are formed integral with the head, and on the other two sides are fastened to the head with screws after the plate is in position. This plate is formed with a central conical boss, through which is an opening large enough for the spindle to freely operate within it. A collar is threaded on to the spindle, and at its lower end is recessed to receive the conical boss on the plate. In channels formed in the head of the tool a number of blades are fastened, certain of which have a saw edge, as shown, for cutting or boring into the wood, and the others have a smooth edge for clearing away the fragments cut out by the saw blade. In the operation of the tool the spindle is to be engaged with the chuck of a lathe, and the frame held stationary. As the spindle rotates a rocking motion is imparted to the head, so that a rectangular hole may be formed in the wood. The spindle is prevented from longitudinal movement with relation to the frame by means of lugs, which engage with the under side of the cross bars. Miss Clara Smith, of Thomaston, Conn., is the inventor of this improved boring tool.



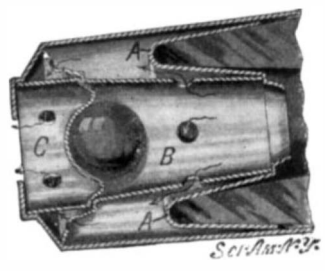
TOOL FOR BORING RECTANGULAR HOLES.

AN IMPROVED BOTTLE CLOSURE.

A patent has recently been granted to Mr. Charles M. Daly, of 538 West 29th Street, New York, on an improved closure for bottles, designed to take the place of a cork and adapted to prevent refilling of the bottles after they have been emptied, thus preventing their reuse after the original contents have been removed. This bottle closure is shown in the accompanying illustration. The parts are such that they can be very easily spun out of suitable metal. A casing, *A*, fits snugly into the mouth of the bottle, and is formed with a petticoat flange cemented to the exterior surface of the bottle neck. The inner end of the casing is rounded to form a valve seat for a ball valve. The ball valve operates within a cylindrical casing, *B*, which is closed at the top by a cupped member, *C*. These parts are all covered by a conical cap piece, which is cemented to the neck of the bottle, and further held by bending it over a shoulder formed on the bottle neck. It will be noted that the upper end of casing *B* is formed with a flange, which fits against the inner wall of the cap piece. Perforations are provided in the flange, also in the main body of the casing, *B*, and in the sides of the cupped member, *C*. When the bottle is tilted the ball valve will roll out of its seat, permitting the contents to flow out of the casing, *B*, then back through the flange into the cupped member, whence they will pour out of the opening in the top of the cap piece. The purpose of providing such a tortuous channel for the liquid is to prevent anyone reaching the ball valve with a wire, and by lifting it to refill the bottle. The opening in the top of the cap piece is closed by a sealing disk provided with an annular flange, which is turned under against the inner face of the cap piece, and thus made fast before the cap piece is applied to the bottle. A rubber washer between the disk and the cap piece insures a perfectly tight joint. The sealing disk may be readily pried off with a suitable instrument.



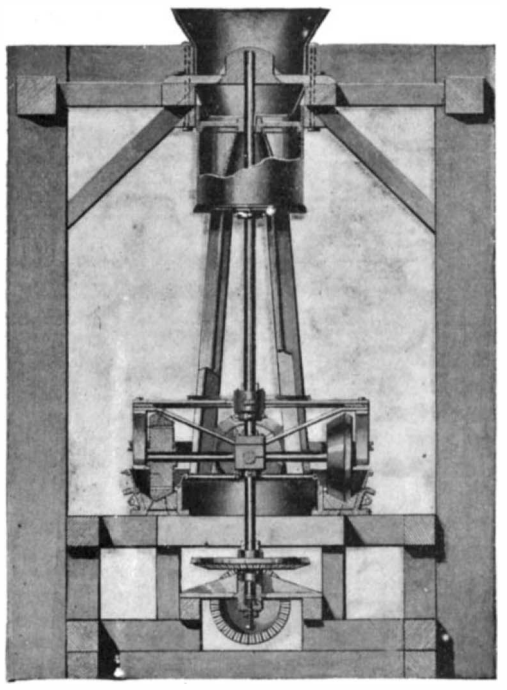
IMPROVED BOTTLE CLOSURE.



An ingenious system of resoling a boot when the existing sole is worn out has been devised by a London inventor. In this boot the outer sole is attached to the inner sole by means of brass screws inserted in a series of eyelet holes round the welt. When it is required to attach a new sole the worn sole is simply unscrewed and the new one substituted. In the case of the heel the screws are driven into holes in the under surface of the heel so that not only do the screws fulfil the function of attaching the new heel, but constitute efficient protectors as well. The attachable soles and heels are standardized in various sizes and can be placed on the market ready for instant attachment. The process of soling and heeling a boot can be accomplished in five minutes. The idea is especially applicable to soldiers' boots where the foot covering is subjected to constant and heavy wear. The main advantage of the device is that no time is lost during the repair of the boot. The American military department has ordered samples of the new boot and proposes to subject them to severe trial by men on active service.

QUARTZ MILL FOR DRY-GRINDING OF ORE.

An improved quartz mill adapted for grinding of ores preparatory to cyaniding, to extract the gold values, has just been invented by Mr. Robert A. Vaughn, 601 Colman Building, Seattle, Wash. In our illustration portions of the mill are broken away to show details. Supported on the lower members of the frame is an annular mortar in which a die is fitted. This die is provided with an annular V-shaped groove. A plate fastened to the inner periphery of the mortar prevents overflow of the material. The outer wall of the mortar is extended by a sectional screen, which may be of any desired mesh. The rollers which operate in the mortar are driven by a vertical shaft, which is journaled in a spider at the upper end and an adjustable step bearing at the bottom. This shaft carries a head from which four arms radiate. Hangers at the ends of these arms and a block on the vertical shaft provide suitable bearings for the shafts on which the rollers are mounted. Each roller consists of a central core, to which annular shells or shoes are keyed. These shoes have inclined faces, to correspond with the die in the mortar. The vertical shaft is driven by a power shaft to which it is geared. By adjusting the step bearing of the vertical shaft, the space between the rollers and the die may be regulated to a nicety. In use the material is fed into a hopper at the top of the mill, whence it passes through a delivery funnel to a feed receptacle, which is keyed to and rotates with the shaft. The conical inner wall of this receptacle directs the material to four chutes, which deliver it to the mortar at the extreme inner edges of the rolls. As the feed of the material progresses, the pulp will rise in the mortar until it passes through the screen, whence it is sucked through a conduit pipe to the cyanide tanks. In use the mill will be inclosed either with matched lumber or metal covering, and a stuffing box will be put around the driving shaft. By this means the air passage is confined to the feed receptacle in such manner as to cause all the fine ore to be lifted or forced out of the mortar, and carried by the conduit pipe to the cyanide tanks. Each tank is closed with canvas except for a central pipe, which leads to the dust room of the mill building. The inclosure of the mill is so constructed that it will be put up in sections, so it can be removed where necessary for cleaning up amalgam. This construction makes it easy and simple to operate without having the nuisance of dust and loss of values in the mill, and prepares the pulp in a thorough and complete condition to get the quickest results and highest saving of values by use of the cyanide. The mill does away with two-stage grinding,

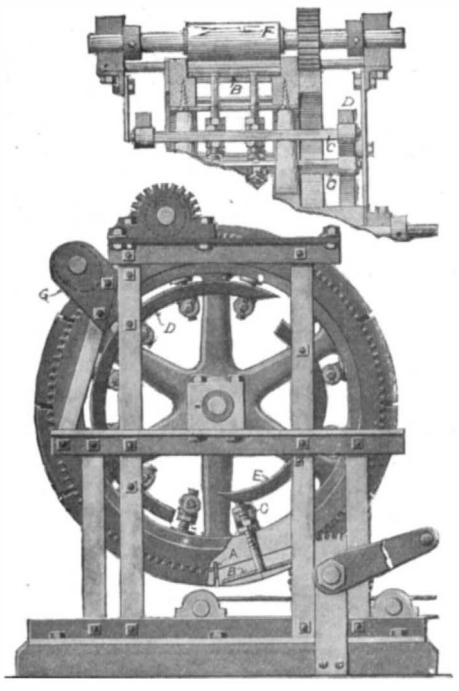


QUARTZ MILL FOR DRY-GRINDING OF ORES.

as it is capable, at all times, of grinding to any desired fineness for a high extraction of the values.

MACHINE FOR MOLDING PLASTIC MATERIALS.

Pictured in the accompanying engraving is an improved machine for molding articles from plastic materials, such as concrete blocks, bricks, ornaments, and the like. The construction of the machine is very simple. It can be easily operated, and is designed to carry on the work very rapidly. It comprises two large wheels keyed to the same shaft, and having their rims connected at intervals by transverse strips *A*. In this way the molds are formed, with the rims serving as the side walls and the transverse strips as the end walls. The bottoms of the molds are formed of plates, *B*, which are adapted to rest on shoulders on the rims, as best indicated in the section view. These bottom plates are adapted to be moved into the mold, to force out the material after it has been molded. To guide the plates in these movements, they are provided with pairs of screw rods, which pass through guide strips attached to the inner periphery of the rim. Firmly secured to each pair of screw rods is a bar, *C*, which is provided with rollers at its outer ends. These rollers are adapted to engage one or the other of two guide tracks, *D* and *E*, which are bolted to the main frame of the machine. Arranged above the molds is a pressing roller, *F*, which is geared to the main mold wheel. This roller is designed to press the material tightly into the molds as they pass under it. As this roller would give a slightly convex outer surface to the material, a second roller, *G*, of oval section is provided, which may be used when desired to give the material a flat surface. In operation as the machine rotates, the plates will be held in their lower or inner positions by the track, *D*, engaging the rollers on the bars, *C*. As each mold reaches the lowest position of the mold wheel, the bottom plate is forced outward by the track, *E*, which forces the molded material out onto an endless traveling belt, and the latter carries the blocks away. Mr. George Stewart, of 433 Fifty-first Street, Brooklyn, New York, is the inventor of this machine.



MACHINE FOR MOLDING PLASTIC MATERIALS.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

ELECTRIC PUMP.—J. C. STOKES, Mansfield, La. In this patent the improvement has reference to pumps, but is of peculiar application upon reciprocating pumps and upon pumps of other types in which it is desirable to have the current reversed by means of a quickly-operating switch.

AUTOMATIC ELECTRICAL SIGNALING APPARATUS FOR RAILWAYS.—A. H. BINYON, 100 Kenilworth Court, Putney, London, S. W., England. The invention relates to automatic electrical block-signaling whereby upon a train entering a block-section the signals controlling that section are automatically put to "danger," and when (but not until) the entire train has passed within the section the signals controlling the preceding section are automatically put to "line clear," the inventor's object being to provide additional safeguards against accidental clearing of the signals.

Of Interest to Farmers.

FENCE.—J. E. TYLER, Roxobel, N. C. In connection with a post, means are provided whereby the lower end of the post is supported clear of the ground, thus avoiding rotting the lower end. The base is formed so it can be manufactured at any suitable point on a farm and then planted in the ground wherever desired and will form a firm solid base for supporting the fence-posts through the medium of the intermediate foot-piece detachably connected with the base and which is secured in connection with the fence-post proper by means of the fencing material. Posts and their foot-pieces may be lifted from the base and shifted from point to point. Means provide for holding the lower edge of the fencing material close to the ground.

Of General Interest.

HEAD FOR WATER CONNECTIONS.—B. RUBISPIERRE, New York, N. Y. The purpose of the improvement is to provide a head for leaders or other water connections which will be exceedingly durable, being constructed of but two pieces instead of the many parts usually employed, and to provide a construction wherein the two parts can be economically made and connected and rendered transversely and laterally strong with the least possible expenditure of labor.

CLASS-REGISTER.—J. S. PRICE, Atlanta, Ga. The register is particularly adapted to serve as a permanent class record for Sunday-schools or other classes or societies. The book is composed of two parts—namely, cards or leaves having rigidity and a cover for the same, which is constructed in U form and to which the leaves are pivoted so they may be folded within it. The inventor has sought to combine maximum compactness with perfect security and protection for the leaves and inscribed matter, as well as ready access to and manipulation of the cards.

DISPLAY-STAND FOR HEADWEAR.—O. PFLEGER, New York, N. Y. This improvement refers to means for supporting male and female headwear, such as hats and bonnets, in a show-window, a case, or other exhibition place, and has for its object the provision of novel details of construction for a portable stand which adapt it for a reliable support of a hat or bonnet in any one of different positions for its attractive and prominent display.

THERMOMETER ATTACHMENT FOR WATER-BAGS.—RACHEL MEYER, New York, N. Y. The invention pertains to vessels, such as water-bags or similar articles used in medical or surgical practice; and the object is to provide means for determining the temperature of the contents. A special object has been to improve the accuracy of the thermometric reading without introducing the thermometer or its bulb into the interior of the vessel.

PROTRACTOR-RULE.—C. W. LINES, New York, N. Y. In this patent the invention has reference to combination-rules and protractors, and has for its principal object the provision of a simple organization which may be effectually used to perform both functions. Its many capabilities render it extremely convenient for use of carpenters and other workmen.

ANNUNCIATOR.—C. W. LEBEIS, Yonkers, N. Y. The annunciator comprises a changeable sign of novel structure, the sign showing one word, symbol, or device in one position and another word or words or symbols when in the other, and said sign is actuated, preferably, by an electromagnet forming part of a circuit which is made or broken by the action of a person leaving or entering an apartment, or by a special switch, or by other means not material to the invention.

SANITARY COMMUNION-CUP.—O. V. L. HARBOUR, Fairmount, Ind. Wine is placed in an inner cup, the central opening permitting introduction thereof. When the cups are tilted, a small amount passes through a series of tubes, and when the cup is returned to its regular position the shield prevents the return of unconsumed wine to the inner cup, and it passes downward through another series of tubes into the space between the cups, from where it may be removed at end of service. After wine is partaken of, a slight turn of the cups within the holder presents a fresh surface for the next communicant and passes a section of the flange through the antiseptic solution in the pad.

TROUSERS-PRESS.—A. E. HAPPEL, Elmhurst, Ill. The provision of a form of trousers-press is the object of this invention. The press is adapted to be placed under the bedclothes or mattress on which the person lies, so that the weight of the person in sleeping will supply the necessary pressure and warmth to neatly press and preserve the shape of the trousers.

DRENCHING-BIT.—J. HINEMAN, Irondale, Ohio. In operation the bit is introduced into the horse's mouth with the toggle bent and the bit-bars in juxtaposition, the nose-strap being over the nose. The yoke is then depressed by means of the handle, extending the toggle and forcing open the horse's mouth. Danger of injury is minimized, since the force is equally exerted on both sides of the mouth and at a point removed from the lips.

SCAFFOLD-HANGER.—M. CODY, New York, N. Y. The object in this instance is to provide a hanger so constructed that in addition to the usual hoisting and lowering tackle employed auxiliary tackle may be suspended therefrom and engaged with the scaffold and serve not only to hold the scaffold close to the wall, but also serve as a safety device should the ropes of the hoisting or lowering tackle be broken or become loose.

ATTACHMENT FOR PHOTOGRAPHIC-PRINTING FRAMES.—F. B. CORE, New York, N. Y. The aim in view of this inventor is the provision of a new and improved attachment for photographic-printing frames arranged to insure a uniform printing of a number of photographs from one negative, so that the photographs are practically alike both as to light and shade.

METALLURGICAL FURNACE. — H. H. GOODSELL, Leechburg, Pa. In the present patent the invention relates to furnaces used for treating iron and steel, but more particularly to an improved type of furnace having certain features in common with the inventor's former application for a furnace for treating sheet iron and steel. By the means employed the plates of iron and steel are given such a color at the start as they ultimately acquire when heated up under atmospheric conditions, so they are afterward unable to change color, nor are they easily disfigured.

ROLL-PAPER HOLDER AND CUTTER.—J. F. FINAN, Cumberland, Md. In this case the invention is in the nature of a paper holder and cutter for holding upon a store-counter or elsewhere a roll of paper from which sheets of varying size may be cut off at will to suit the size of package to be put up.

WOVEN FABRIC.—H. SARAFIAN, Yonkers, N. Y. In the present invention Mr. Sarafian has aimed at producing a fabric which combines a body or ground portion having maximum cheapness, strength, and durability, with a top or surface portion formed of better material, which may be attached to the body in the process of weaving the latter without any special manipulation of the loom.

DISPLAY-HOLDER FOR HANDKERCHIEFS, ETC.—G. W. EBRIGHT, Xenia, Ohio. This holder displays in suspended position handkerchiefs, neckties, ribbons, laces, and other similar articles in stores in such a way as to exhibit the patterns of the same in an attractive way, to hold a large quantity of them in available position for sale, and to so secure them as to permit them to be inserted and removed with great facility and without danger of tearing or soiling the delicate fabrics.

MEAT-TENDERER.—D. B. DATE, North Franklin, Conn. The purpose of the invention is to provide a meat-tenderer of exceedingly simple, durable, and economic construction and which can be conveniently and quickly manipulated and which will effectually sever or break down all sinewy particles in the meat and yet leave the material in a connected, compact, and tender condition.

METHOD OF PRESERVING AND WATER-PROOFING WOOD.—J. A. DEGHUEE, New York, N. Y. The invention in this improvement is to so prepare wood that it will resist attacks of animal and vegetable life, and thereby prevent decay, and also to prevent the penetration of water, and to thereby especially adapt it for use in the manufacture of paving-blocks.

MINER'S CANDLESTICK.—T. W. CONKLIN, Mullan, Idaho. The invention pertains to an improvement in candlesticks or holders intended more especially for use in mining, its object being to provide a candlestick which will be simple, consist of few parts, one which cannot become clogged with dirt, etc., and one in which the necessary parts can be locked in either open or closed section.

EDUCATIONAL APPLIANCE. — J. H. FITCH, Jeffersonville, Ind. The invention is an improvement in educational appliances, being in the nature of clock-blocks. It gives suitable problems to a child and affords amusement and instruction. By the use of the blocks a child of proper age can quickly learn the Roman numerals, their right position, and tell the time as indicated by the hands on the blocks; also months, number of days in the same, and the seasons. Blocks carrying the representation of the minute hand may be arranged to indicate time in periods of five minutes, which is ordinarily the first step taken in learning to tell the time.

Household Utilities.

FOOT-REST FOR CHAIRS.—W. L. HOFFMAN, Jersey City, N. J. This improvement pertains to attachments for chairs, the object being to provide a device which may be conveniently applied to a chair so as to constitute a foot-rest. It also affords a convenient rest for blacking shoes, tying shoe-laces, etc., and may be easily folded into substantially concealed position when not in use.

CURTAIN-POLE SOCKET.—J. KRODER, New York, N. Y. The object in view of this invention is to provide a new and improved curtain-pole socket arranged to permit convenient attachment of the socket to the sides of the window-frames close to the top cross-bar and to give a neat appearance to the entire structure.

Machines and Mechanical Devices.

BOTTLE-CORKING MACHINE. — J. B. DAVIS, Gainesville, Fla. The machine is especially adapted for forcing what is known as "spring-stoppers" into bottles and it is so constructed that it will be simple, effective in operation, and capable of being quickly and readily operated. The machine includes a pedal-controlled adjustable plunger and a tubular tension-controlled guide member adapted for directing the stopper to the mouth of the bottle, and a plunger which operates upon the stopper in the guide member.

MACHINE FOR MAKING COTTER-PINS.—F. D. COPPAGE, Terre Haute, Ind. In this patent the invention is an improvement in machines for making what are known as "cotter-pins" or devices formed by bending a wire blank midway of its length to form an eye, the two arms or legs being brought together and their ends pointed.

LUMBER MEASURER, MARKER, AND RECORDER.—C. G. BLADES, Newbern, N. C. It is the purpose of this invention to provide an apparatus for automatically measuring the superficial area of boards or other lumber having a flat face and for recording and marking the number of square feet thus ascertained, both upon the lumber itself and upon a band or tape which is fed or caused to travel corresponding to the aggregate width of the boards measured.

TRUCK FOR MOLDING MACHINES.—W. SIEBER, Henderson, Ky. This improvement relates to that system of molding concrete blocks and other articles which has for its basis the use of a series of pallets located along the floor of the plant and the transfer of the mold from one to another and leaving the molded articles upon the pallets after the mold is removed. Especially it relates to means for supporting and moving the mold from one pallet to another along the tracks, said means being provided with a tamping device and a mold-removing device and means for centering the mold with respect to the various pallets.

WIRE-WORKING MACHINE.—A. H. NILSON and M. OLSON, Bridgeport, Conn. While the machine and the several features thereof are capable of performing certain operations to manufacture various articles from wire, it is designed especially for forming continuous zigzag pieces of wire, having hooks, a number of said wires being capable of being connected together in such a manner as to make a fabric for beds and other purposes.

Prime Movers and Their Accessories.

ROTARY ENGINE.—P. BARTOLETTI, Brownsville, Pa. The object of the invention is to provide a new and improved rotary engine which is simple and durable in construction, very effective in operation, and arranged to permit quick and convenient reversing and to utilize the motive agent to the fullest advantage.

VALVE-GEAR AND AUTOMATIC CUT-OFF FOR STEAM-ENGINES.—H. DUNLAP, Memphis, Tenn. The invention consists in the novel construction and arrangement of parts operating in conjunction with a rotary valve made in three parts arranged in axial alinement, the middle part of which forms the exhaust-valve and rotates continuously in one direction and the two outer end parts of which form oscillating induction-valves and are operated by separate coacting cut-off devices.

ACCUMULATOR.—R. W. WILSON, Noblesville, Ind. This improvement refers to apparatus for storing energy, and regulating its application, it being particularly adapted for use in connection with such motors of irregular speed as windmills, which are applied to the pumping of water. Its principal objects are to provide automatic means for controlling the reception and delivery of energy by the accumulator and to generally improve the construction of apparatus of this class.

ENGINE.—C. V. FRISK, Chicago, Ill. In this case the invention relates to improvements in steam-engines of the tandem or compounding type, the object being to provide a novel form of valve mechanism whereby the live steam may be first directed into the low-pressure cylinder for starting the engine, thereby giving a much greater power than that of a simple single-cylinder engine.

ROTARY ENGINE.—I. DAVIS, New Haven, Conn. This invention is an improvement in the class of rotary engines which are particularly adapted for use of steam or compressed air. The pressure upon the piston is continuous in one direction, and, the exhaust taking place at the time a charge is admitted there is no possibility of back pressure.

Railways and Their Accessories.

RAILROAD-TRACK.—E. F. SEIDER, Upper Sandusky, Ohio. The invention relates generally to that class of rail-securing devices shown in Mr. Seider's former application for patent. In the present invention he employs a pawl arranged at its free end to lock the spike, and also employs in connection with the spike a pawl and clasp having a portion passed through an opening in the rail-supporting plate and provided with upper and lower portions, the upper engaging the rail-base and the lower engaging below the rail-supporting plate, the spike being arranged to secure the rail-clasp in engagement with the rail and its supporting-plate. This inventor has obtained another patent on a railroad-track, in which he is able to release one or both of the pawls from engagement with their respective spikes when removing the spikes. The pawl-carrying plates and their hooks and pawls being alike, they may be used interchangeably and no necessity of making them in rights or lefts, thus dispensing with unnecessary duplication of patterns and the like in the manufacture of the device. Furthermore, by engaging the hooks of the plates directly with the rail-base and utilizing the spikes in securing the hooks in such engagement and the pawls for locking the spikes he is able to reduce his rail-fastening to the simplest possible form.

FLUID-PRESSURE BRAKE.—M. F. VOLKMANN, Santa Monica, Cal. The invention relates to fluid-pressure brakes of the Westinghouse type; and its object is to provide a brake arranged to permit the engineer to directly control the retaining-valves with a view to recharging the auxiliary reservoirs without first releasing the brakes and to allow of increasing the pressure in the brake cylinders after the auxiliary reservoirs are recharged.

METALLIC RAILROAD-TIE.—A. M. BAIRD, Topeka, Kan. The object of this invention is to provide a metallic railroad-tie which is simple and durable in construction, cheap to manufacture, and arranged to combine the utmost strength with lightness. In the manufacture of the ties and tie-plates it may be desirable to have the same mill-rolled, hydraulic-pressed, or bulldozed from steel plates; but other methods of making them may be employed.

RAIL-JOINT.—G. T. JOSEPH, Covington, Va. Mr. Joseph's invention is an improvement in rail-joints. The construction is simple, easily applied, and forms a secure connection between the meeting ends of the rails. Among the various advantages are the following: When a rail has been worn on one side, it may be reversed in order to bring the other side into wearing position. Means enable a track-walker to determine at a glance whether the connecting-bar is fractured or the integrity of the connection has been disturbed. Limited longitudinal movement of the rails is permitted for expansion and contraction in use. Means are provided to prevent any twisting of the base positions in the use of the invention. Also means for bridging the space between any two ties and forming a firm support for rail ends in all positions of the parts.

Pertaining to Recreation.

TABLE.—I. MASON, New York, N. Y. This invention relates particularly to improvements in card or similar game tables, the object being to provide a table of this character with a top having receptacles for conveniently holding cards, counters, and the like, the table also having a pedestal in which various articles may be stored.

BILLIARD-TABLE.—G. A. ELLISS, Lithgow, and P. J. MCGUIRE, Goulburn, New South Wales, Australia. Automatic means are provided for conveying the balls from cushion-pockets to either end of the table and for conveying the red ball from the "balk" end to the "spot" end. Along each side of the table below the cushions an inclined race is constructed, into which balls pass from the pockets and along which they roll by gravity to another race along the balk end and thence into a receiver medially placed therein. Extending from this central receiver beneath the table center is another race for carrying the red ball from this central receiver to the spot end of the table.

Pertaining to Vehicles.

CUSHION-TIRE.—C. G. SHAW and W. J. SHAW, Los Angeles, Cal. This invention has reference more especially to tires for the wheels of automobiles, bicycles, and the like, though applicable to the wheels of other vehicles; and one of the principal objects thereof is to provide means for increasing the strength and wearing qualities of the tire generally, but more especially the thread or bearing portion thereof.

WHIFFLETREE-COUPLING.—G. L. MILLER, Socialville, Ohio. One purpose of the invention is to provide a simple, durable, and economic form of swingle and double tree irons adapted especially for pivotally connecting the doubletree of a whiffletree to the pole or tongue of a vehicle and also for pivotally connecting the swingletrees to a doubletree; but the couplings may be employed with equally good results in connection with kindred articles.

DUMPING-WAGON.—T. J. COPE, Philadelphia, Pa. There is provision in this vehicle

for discharging the load of the body at the side of the wagon, thus avoiding obstruction of the street or railway thereon, provision being also made for placing the body in inclined position, so as to elevate the place of discharge, and, furthermore, to elevate the body to a greater degree and permit inclination of the body at its highest point, so as to dump the load at different altitudes relatively to requirements due to different positions of the place designed to receive the load in a cellar or elsewhere.

TRUCK.—E. F. SHERRILL and B. R. SHERRILL, Moline, Ill. In this patent the invention is an improvement in trucks and especially in that class of trucks designed for use in handling baggage, bricks, and the like, wherein it is desired to raise the articles to a higher level in some instances and to lower them from a higher level in other instances.

Designs.

DESIGN FOR RUFFLING.—C. SEIDEL, New York, N. Y. The designer has invented a new, original and ornamental design for ruffling which represents a width of material made up of comparatively heavy and light double and singie cross-lined strips. Single and double cross-waved patterns run through the cross-lined portions.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**
MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 7512.—For makers of the instrument called the "Leak Finder," used for locating leaks in underground water mains.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 7513.—For machines to make stapled and drawn push brooms.

For bridge erecting engines. J. S. Mundy, Newark, N. J.

Inquiry No. 7514.—For makers of rubber pillow ventilators.

Drying Machinery and Presses. Biles, Louisville, Ky.

Inquiry No. 7515.—For makers of typewriter parts, such as machine parts.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 7516.—For makers of garment hangers made of wood.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co.. Box 13, Montpelier, Vt.

Inquiry No. 7517.—Wanted, makers of an article for waterproofing silk without injuring the fabric or lessening the flexibility of same.

I sell patents. To buy, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

Inquiry No. 7518.—Wanted, catalogue of latest machinery for making peat bricks for fuel.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company, Foot of East 138th Street, New York.

Inquiry No. 7519.—For makers of bare and insulated copper magnet wire.

WANTED.—Young man experienced in drafting and designing textile machinery "New England." Machinery, Box 773, New York.

Inquiry No. 7520.—Wanted, machinery to make briquettes from sawdust.

WANTED.—Ideas regarding patentable device for water well paste or mucilage bottle. Address Adhesive, P. O. Box 773, New York.

Inquiry No. 7521.—Wanted, makers of metal fountain syringes.

LATEST ADVERTISING NOVELTIES.—High-grade Illustrating, Designing and Printing. Catalogues a Specialty. Smith & Berkley, Holland Bldg., St. Louis, Mo.

Inquiry No. 7522.—Wanted. a saw operated by electricity, gas or steam for sawing trees.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery tools and wood fibre products. Quadriga Manufacturing Company, 18 South Canal St., Chicago.

Inquiry No. 7523.—For importers or makers of colored glass bead fringe used in making lamp shades; also for makers of stamped brass beading and moulding used in this work.

Absolute privacy for inventors and experimenting. A well-equipped private laboratory can be rented on moderate terms from the Electrical Testing Laboratories, 548 East 80th St., New York. Write to-day.

Inquiry No. 7524.—For makers of high resistance wire of small size, suitable for hot wire electrical instruments.

INVENTIONS WANTED.—Undersigned will consider one or two good patented or patentable inventions to manufacture on royalty. Something in popular demand preferred. Honest treatment guaranteed. F. Raniville Company, Grand Rapids, Mich.

Inquiry No. 7525.—For makers of postoffice caves.

WANTED.—Competent man who has knowledge of Mechanical Engineering, to take a position as traveling salesman for the selling of construction material used in Insulating Refrigerating Plants. Apply by mail to the Bruening Cork Company, Oakdale, Allv Co., Pa.

Inquiry No. 7526.—For parties to manufacture motor cars for street car service, gasoline system.

Inquiry No. 7527.—For manufacturers of wire-forming machinery.

Inquiry No. 7528.—For makers of tape measures in metal boxes, having springs inside for winding.

Inquiry No. 7529.—For a machine for cutting right-angle, circular and oval beveled openings in mat board.

Inquiry No. 7530.—For manufacturers of ventilators.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9844) C. E. D. writes: In your answer to J. S., No. 5703, September 23, 1905, you say a person is no heavier while going up an elevator than going down, and explain the effect of inertia on the matter. It seems to me this does not cover it. Either the attraction of gravitation must be considered as a fixed something which exerts its pull without moving (an inconceivable thought to me) or else it must have a speed at which it pulls, just as light or electricity has a speed at which it travels. If it is admitted to have a speed, then this speed must be between 0 and infinity, and therefore measurable. If it had an infinite speed of action, any mass multiplied by this speed of action would be infinitely heavy, and therefore impossible to weigh. It would seem, therefore, that gravitation must have an appreciable measurable speed, and that if we could find an elevator with a constant speed, one would weigh as much less when coming down as the speed of the elevator takes from the speed of gravitation, while in going up the conditions would be reversed, and one's weight would be increased in the proportion that the speed of the elevator adds to the speed of gravitation. Is not this correct? A. The theory of the intrinsic nature of gravitation is not by any means settled among scientists. Indeed, there can hardly be said to be such a theory. There would seem, however, to be a substantial agreement that gravitation acts instantaneously through space. That gravitation has a velocity would hardly be considered a suitable expression of this fact. Nor do we see how the velocity of gravitation can have anything to do with the weight of bodies. This is determined by the relative amount of matter in the earth or major body and the body to be weighed, as we call it, and the distance between the centers of gravity of these two. It is not involved in the question of the speed of action of gravitation. Even if it were, the speed of action of gravitation is so enormous that any change of velocity in a moving body cannot affect the actual weight of that body, and all weighings at the same distance from the center of the earth are affected by it to the same extent, so that, like every other constant, it is omitted in considering the changes of value of the variables in an expression.

(9845) D. E. F. writes: I note the inquiry of L. A. H. (9779) in a recent issue of the SCIENTIFIC AMERICAN which I here quote: "Is there such a thing in the realm of science as flame or combustion without emitting light?" I take it that he means *rapid* combustion. That even in this sense the answer is "yes" you can really demonstrate in the following manner by means of the inclosed cards of thin, transparent celluloid. Soak the celluloid over night in water. Take them out of water and wipe dry and let dry an hour or two. In a moderately warm room free from strong drafts, hold the card of celluloid vertically in the left hand and light the upper end with a match. When it burns down about half an inch blow it out. Thereafter there will be no light or incandescence even in the darkest room, but the charring of the celluloid will continue to run downward and disappear, leaving only a trace of ashes. The samples which I inclose herewith do not work as well as some which I have heretofore tried, which continued to disappear until the whole card was consumed, but these suffice to completely demonstrate this remarkable phenomenon. I think this celluloid is a little too thin to work well. I also inclose several white celluloid washers, which seem to be more efficient in demonstrating the phenomenon than is the transparent celluloid. Let about one-third of the disk burn before blowing it out. Soak these in water as indicated, then at once dry by pinching between blotters and burn. A. We have been interested in burning the pieces of celluloid you send us, as well as other pieces. They smoulder after the flame is extinguished, as do other combustible materials, until the substance is cooled below the temperature at which combustion ceases. We are not able to make the thin transparent celluloid burn any after the flame is extinguished. The white, thick disks contain some paint-like material, used for filling, which carries on the combustion longer. We are just as successful without soaking in water as when the pieces are soaked. This is just as we should expect, since celluloid does not contain any ingredient which is soluble in water and it is impervious to water.

NEW BOOKS, ETC.

MACHINE SHOP TOOLS AND METHODS. By W. S. Leonard. New York: John Wiley & Sons, 1905. 8vo.; pp. 554; 689 figures. Price, $4.

This is a very complete textbook of machine-shop tools and methods, which was written for use in connection with lectures on this subject given in the Mechanical Department of the Michigan Agricultural College. The book describes in detail all the various tools, both large and small, used in the modern machine shop. While necessarily somewhat elemental in character, it nevertheless contains a deal of information valuable to the ordinary machinist. It is very thoroughly illustrated with diagrams and half-tone plates. The present is the third edition, which has been thoroughly revised and enlarged.

ENGINEERING CHEMISTRY. By Thomas B. Stillman, M.Sc., Ph.D. Easton, Pa.: Chemical Publishing Company, 1905. 8vo.; pp. 597. Price, $4.50.

In this, the third edition of a well-known manual on quantitative analysis, the author has taken note of the rapid changes during the past few years in methods of testing the various products of chemical technology and materials of construction, and he has completely revised that portion of his work that has to do with these subjects. Much additional matter has been included, especially information pertaining to asphalt, lubricating oils, Portland cement, and the technology of the products of the blast furnace. The book is fully illustrated, and is quite up to the standard of the previous editions, and will be found valuable to all students, chemists, and engineers.

COMMERCIAL ECONOMY IN STEAM AND OTHER THERMAL POWER-PLANTS. By Robert H. Smith. With numerous diagrams by H. Malcolm Hodson. Philadelphia: J. B. Lippincott Company, 1905. 8vo.; pp. 291. Price, $7.

The main idea of the author in writing this work was to persuade the mechanical engineer to advance from the primitive view that engineering science can guide him only in the physical construction and dynamics of his machinery to the more complete idea that scientific method must also be applied to his reckonings of cost and value produced. The ultimate triumph of practical science must, the author believes, be evidenced in its demonstration of the means to attain maximum economy. An exact measure of economy is the first essential in any section of technico-commercial science. The author, therefore, discusses an "Economy-Coefficient" applicable to all kinds of productive industry, and also probably to the industry of distribution and exchange. By a simple combination of the three factors of Cost, Value, and Speed of Production, this coefficient aims at giving due value to all essential elements of commercial economy. The author also deduces other coefficients which are of value in the discussion. The book goes into commercial steam-power economy in a very thorough manner, and has numerous charts relating to this and kindred subjects. It is very complete and will be found to contain many useful ideas regarding economy in the operation of power plants.

PRACTICAL KITES AND AEROPLANES. By Frederick Walker, C.E. London: Guilbert Pitman, 1903. 16mo.; pp. 78. Price, 60 cents.

The kite, from the toy of a schoolboy, has, by the ordinary laws of mechanical evolution, developed into the aeroplane, capable of carrying loads vertically, and sustaining them at a certain altitude by the ordinary wind currents, but so far the airship of the future as a problem admits of no solution by the aeroplane or aero-curve surface alone; unless it may happen to a future inventor to cause a flat disk, of gas or air, which by its inherent high pressure shall impinge upon the inner surface of an aero-curve and by diversion overcome gravity, and thus cause a vertical ascension. This may occur in the future; but according to our present lights a captive aeroplane may be only used for raising a single passenger to the height permitted by the tension rope or cord and the pressure of the air current prevailing in the atmosphere. The author desires to create interest in the subject by a timely little book.

THE INDUSTRIAL AND ARTISTIC TECHNOLOGY OF PAINT AND VARNISH. By Alvah Horton Sabin, M.S. New York: John Wiley & Sons, 1905. 8vo.; pp. 372. Price, $3.

This is a very complete technical work on the subjects of paints and varnishes. A brief account of their modern use, and of the principles involved in their fabrication and application, will be found within its pages. Among the subjects treated are Varnish and Its Manufacture; Linseed Oil; Tung Oil; Rosin; Japans and Driers; Varnish or Enamel Paints; Chinese and Japanese Lacquers; and Spirit and Pyroxylin Varnishes. A chapter on the protection of metals against corrosion is one of the most useful in the book. Other chapters deal with Water Pipe Coating; the Painting of Ships' Bottoms, and Ship and Boat Painting as well; Carriage Painting; House Painting; and Furniture Varnishing. The book is illustrated with a number of half-tones, and will be found interesting reading by all who have to do with this industry.

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Coupling, J. & J. O. Timms..... 804,276
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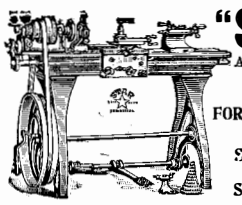

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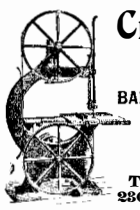

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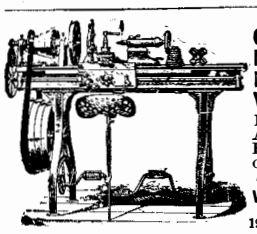

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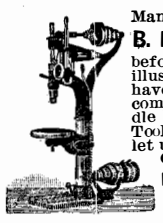

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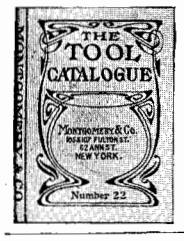

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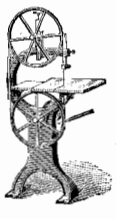

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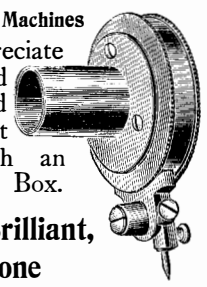

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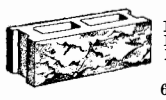

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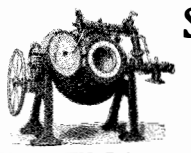

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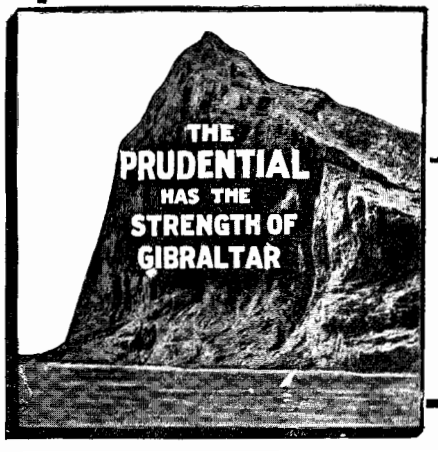

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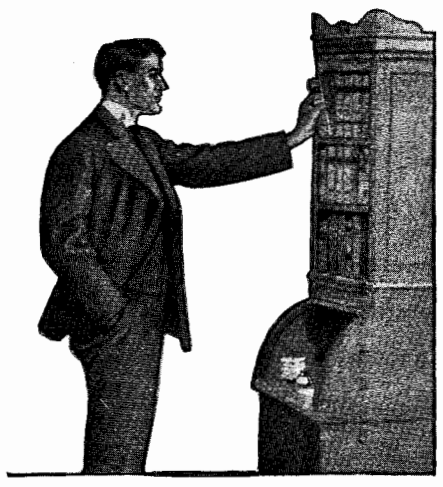

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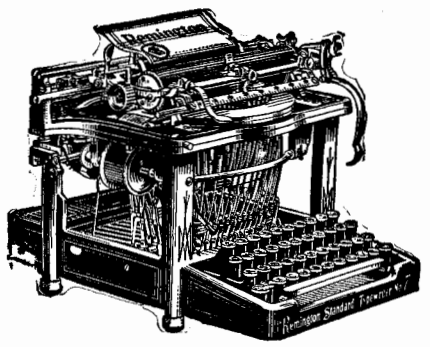

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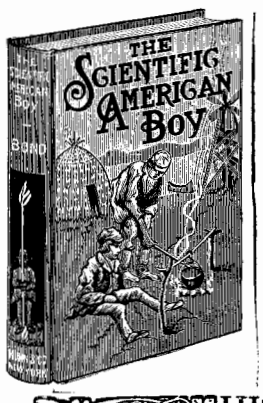

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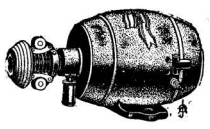

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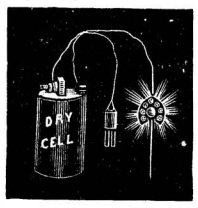

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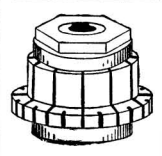

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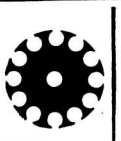

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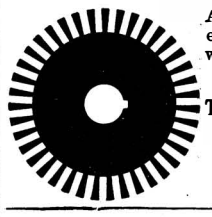

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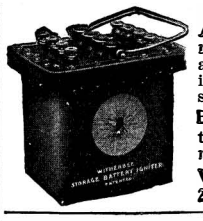

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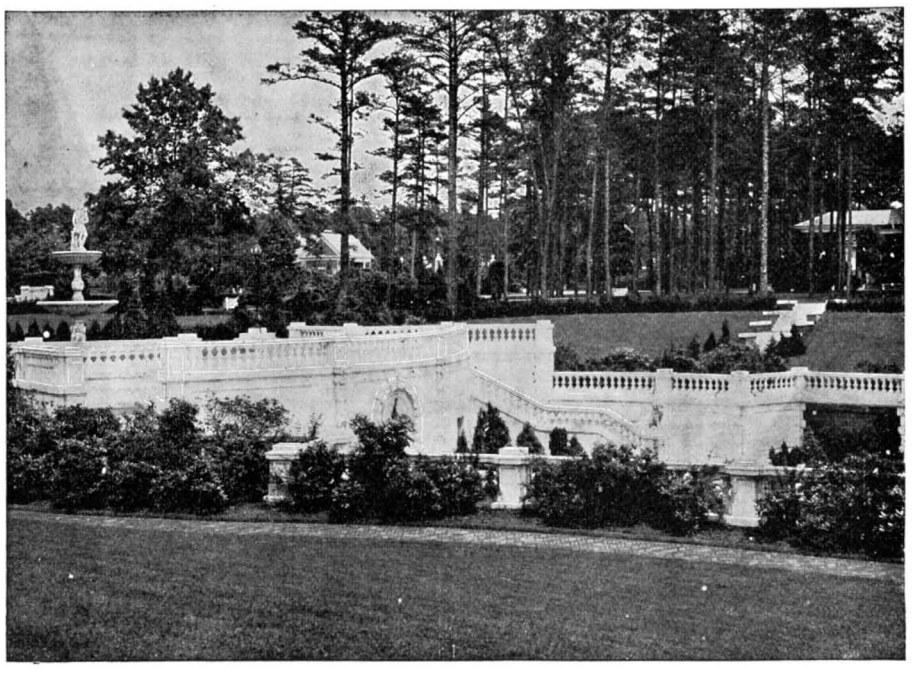

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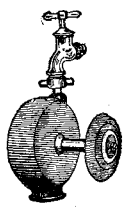

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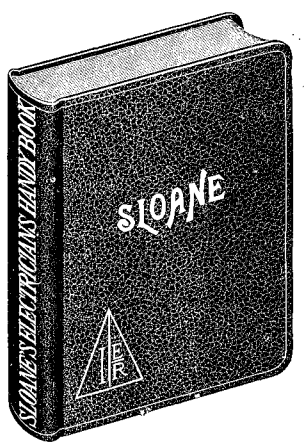

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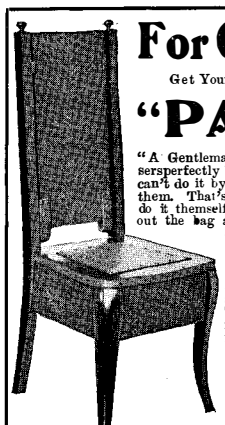

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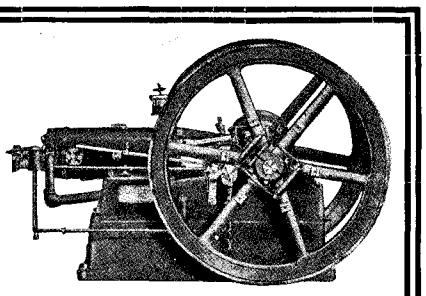

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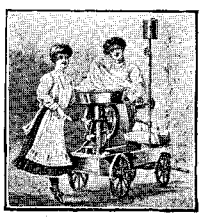

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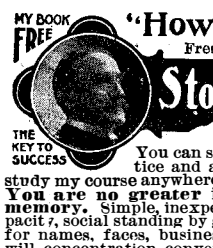

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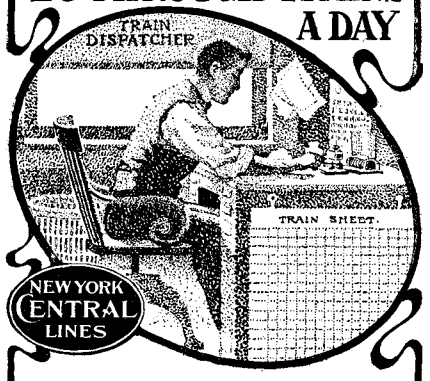

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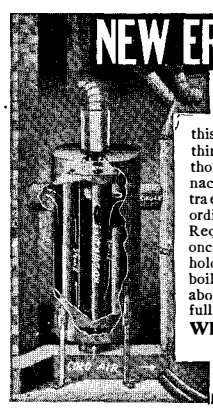

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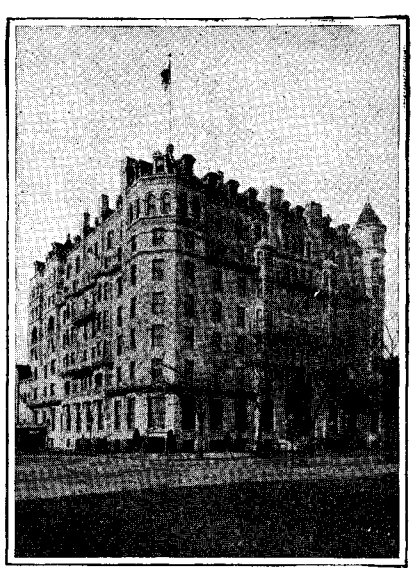

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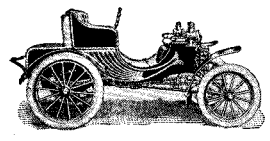

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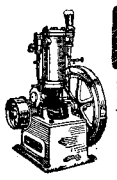

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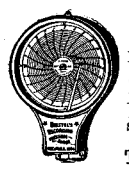

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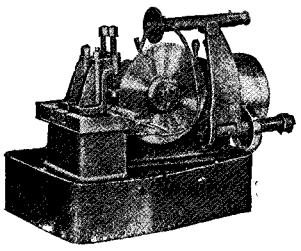

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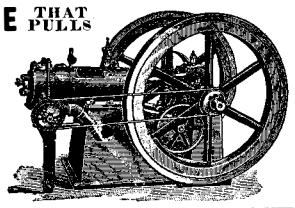

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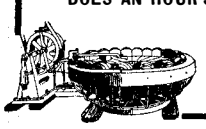

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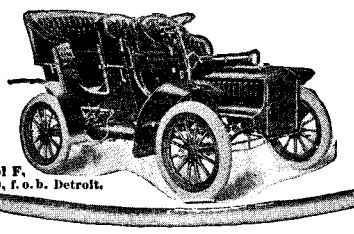

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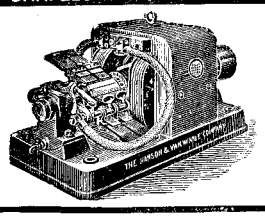

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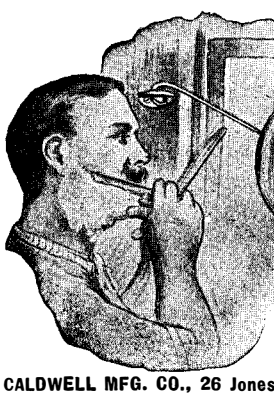

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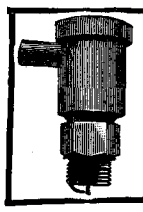

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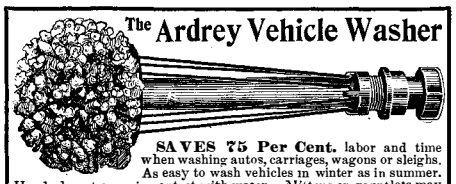

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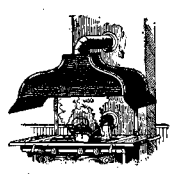

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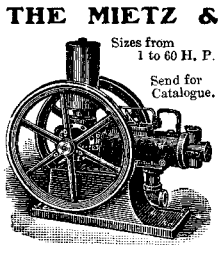

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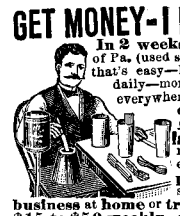

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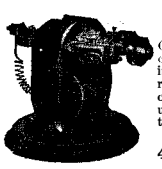

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